SCIENCE

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Vérité sans peur.

CAMBRIDGE, MASS.: THE SCIENCE COMPANY.

FRIDAY, JULY 4, 1884.

COMMENT AND CRITICISM.

THE 'sundry civil bill,' which is still under discussion by congress, provides $501,470 for the coast-survey; $244,500 for the fish-commission; $500,000 for the participation by the government departments in the industrial exposition at New Orleans, of which sum one-fifth is given to the Smithsonian institution, including the national museum and the fish-commission; $40,000 for the protection and improvement of the Yellowstone national park; $467,700 for the geological survey; $10,000 for the census of 1880, providing for its close in November next; $149,500 for the national museum; $55,000 for the Smithsonian institution (construction); and $868,038.60 for the signal-service.

It also disposes, for the time, of the question raised concerning the coast-survey, by providing for a joint commission of three senators and three representatives, to "consider the present organizations of the signal-service, geological survey, coast and geodetic survey, and the hydrographic office of the navy department, with the view to secure greater efficiency and economy of administration of the public service in said bureaus," and to report next December. It further appropriates seven hundred dollars for a commission of scientific men, to be appointed by the president, "to inquire into the organization, work, expenses, and reconstruction of the naval observatory, and to report to congress the best system for its future management."

We shall look with deep interest and concern for the reports of these commissions. On the one hand, we are to have a commission of men of affairs, called to consider the mutual standing of several different government bureaus, whose work is more or less inter-related; on the other, a scientific commission, dealing with a purely scientific bureau under naval control, but the vitality and usefulness of which has come, with rare exceptions, from men drawn from the ranks of civil life. Let us hope for good appointments, that these often-recurring and unseemly antagonisms between different departments may be put to rest by excellent reports and wise adjustments. To the question of the relations of the army and navy to science, we may again recur. We may here only regret that it was not arranged that the scientific commission should be taken from names recommended to the president by the National academy.

With this exception, we have no fault to find with another provision of the bill, by which, as we hoped last week would be the case, the appointment of two additional members to the meridian conference is provided for, and an appropriation of two thousand dollars made for the expenses of the commission; nor with a similar provision for a national conference of electricians, in connection with the international electrical exhibition at Philadelphia, for which a meagre five thousand dollars is appropriated, and a scientific commission authorized. The more closely the government can identify the National academy with its scientific undertakings and appointments, the more confident we shall feel that neither science nor our country will be belittled.

THE use of the comma as an instrument for assisting or impeding a reader's comprehen-

sion of an author's meaning is neither a very important nor a very scientific subject of discussion. But many English writers of scientific text-books try one's patience so sorely and so wantonly on this point, that it seems proper something should be said about it. The evil to which we refer usually takes the shape of the insertion of superfluous commas, which in the least obnoxious cases are annoying, and in many cases seriously interfere with the sense. These violations of the literary code of minor morals are so abundant in any work which is seriously subject to them at all, that it is not necessary to go outside the book which happens to be before us at the moment for as long a list of examples as might be desired. The following sentence contains three unpardonable commas, the fourth alone being rightly used: "Thus we shall suppose that the external cause of the cooling determines always the state of the very thin envelope, in such a manner that the value of $\frac{dv}{dx}$ which results from this state, is proportional to the value of v, corresponding to $x = X$, and that the constant ratio of the two quantities is $-\frac{h}{K}$." And before we have finished a page, we come upon this: "It consists in finding the value of v, by means of the general condition, and the two special conditions to which it is subject." Here the insertion of the first comma seems to us bad enough, but this may possibly be regarded as a matter of taste; that of the second is an inexcusable error.

The September meeting of the mechanical section (D) of the American association for the advancement of science, at Philadelphia, promises well. It is under the leadership of a chairman whose name will go far to insure success; and Professor Thurston's opening address is confidently expected to be a paper of much interest. The circular of invitation, issued by the committee, has been sent to a large number of engineers, representing the most of the American societies; and it has also been laid before them officially through their secretaries, besides being published in a number of prominent technical journals. The work is now going forward of interesting the foreign engineering public directly, and through their societies and journals; and it is believed that a large foreign attendance may be expected. The programme is also being made up, and contains the announcement of several important papers.

After an existence of eight years, the New-York state survey is brought to a close by the will of one man. Like nearly all scientific work done in this country under state patronage, the life of the survey hung by the thread of an annual appropriation. The usual appropriation of $15,800 was made by the legislature; but the item was vetoed by the governor, who thinks, that, "after an expenditure of a sum considerably in excess of a hundred thousand dollars, very little seems to have been done of practical benefit to the people," and who says that he is "not able to appreciate the importance of the elaborate, slow, and expensive survey of the state which this appropriation is intended to continue."

As Gov. Cleveland is commonly reported to give his reasons for official action with perfect frankness, it is evident that this unfortunate close of the survey is due to his ignorance of the value and of the cost of geodetic work. Had he urged that the work was one which should be undertaken by the general government rather than by the state, he would have found many to agree with him, and, at most, the question would have been one of policy; but, when he declares that he is "of the opinion that a sufficiently correct and exact location of boundary-lines and monuments to answer every useful purpose could be conducted . . . at a comparatively small expense," it is plain that his 'opinion' on such a topic is not of weight. Even on economic grounds, it would not be difficult to show that the exact location of bases for local surveys would, in time, save its cost in diminished boundary litigation.

COMMENCEMENT at Harvard last year was enlivened by the vigorous speech of Charles Francis Adams, initiating what may almost be called a national discussion of the Greek question. This year the subject of 'academic degrees' is brought into prominence by a paper, published in the July *Century*, from the pen of Dr. Woolsey. It will not surprise us if a discussion of this subject, begun by one who has held with honor the post of president of Yale college, and is still a member of the degree-giving board, should run for the next twelve months, and draw out opinions as diverse as those lately printed on the comparative value of classical and scientific studies. Most of Dr. Woolsey's article is historical, with incidental references to his own opinions. Toward the close, however, he makes some suggestions with respect to the bestowal of honorary degrees which are worth consideration. He is heartily opposed to the random methods now in vogue of complimenting men who are accidentally brought forward. He does not object to the guarded admission of meritorious students to the lower academic degrees *causâ honoris*, when they have been prevented by illness or poverty from attaining their diplomas in a regular way; and in cases of rare and distinguished merit he would admit to the same honors "discoverers of important principles in science, who had had, perhaps, no public education whatever."

But in respect to what are now bestowed as honorary titles (the degrees of LL.D. and D.D.), he would allow any graduate to prepare, by the study of years, for the highest degree within his reach, whether he resides within the college or not. The proficiency of each candidate should be tested by rigid examinations. Thus a student of law or theology might first take a baccalaureate degree in either of these faculties, — say, four years after taking his B.A. degree, — and eight years still later he might offer himself as a candidate for the degree of doctor of laws or theology. As a protection against the confounding of titles honorably won with those bestowed by careless or feeble institutions, Dr. Woolsey suggests that the indication of a degree shall be followed by the name of the place where it was won. We imagine that it will amuse some readers, and amaze some others, when they read the melancholy statement, made by one who for nearly forty years has been annually creating honorary doctors, that "these honorary degrees are bestowed on no evidence of thorough learning in theology or in law, and thus are in no way certificates of deserving the honors, saving, that, for some reason or other, the corporation of a college regards the person thus honored as a man worthy of notice beyond most of his fellows."

ABOUT two months ago we urged the Massachusetts legislature to be slow in rejecting the offer of the U. S. geological survey to prepare at divided cost a topographical map of the state. We are glad to state that the committee on expenditures, in whose hands the matter was placed, reported favorably; both houses passed the resolve submitted; and the governor has now made the excellent choice, as commissioners, of Pres. Francis A. Walker of the Massachusetts institute of technology, Mr. Henry L. Whiting of Tisbury, and Prof. N. S. Shaler of Harvard college. The resolve appropriates forty thousand dollars, to be extended over at least three years. The names of the commissioners are a guaranty that the interests of the state will be well administered, and that the suggestions made in our columns will not be lost sight of.

LETTERS TO THE EDITOR.

**** Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

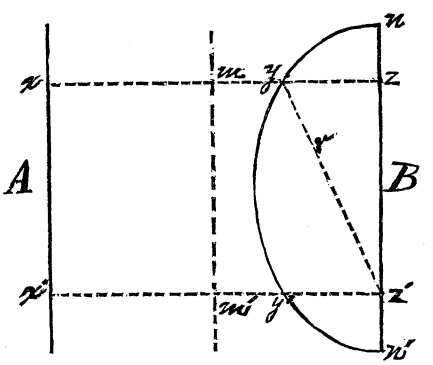
Radiant heat.

IT is much to be regretted that a mathematical physicist of the standing of Mr. Fitzgerald should, in his letter published in your issue of May 16, confine himself to *ex cathedra* deliverances upon the question at issue between us, instead of attempting some direct demonstration upon the points involved, as I had suggested would be desirable. Had he done so, he would not, I am sure, have fallen into the curious mistakes which he emphasizes so strongly. In default of the desired investigation of the question by Mr. Fitzgerald, I hope that the following reasoning

may be of use in arriving at correct conclusions regarding this matter.

Let z and z' be taken as the foci of a semi-ellipse, $nyy'n'$, whose major axis is nn'; and let the eccentricity be so small that zy is greater than $\frac{1}{4}nn'$. Make $xz = nn' = 2xm$. Let a concave reflecting surface be supposed to be generated by revolving the semi-ellipse through angles of $+\frac{1}{2}\pi$ and $-\frac{1}{2}\pi$ about nn'; and let nn' represent a screen in which there are equal small circular apertures at z and z'; let there be also equal apertures at x and x'; and, in addition, let there be apertures at y and y' no larger than will permit the passage of cylindrical beams from the apertures at z and z' respectively.

At first let the apertures x and z' alone be open, and remain so until the spherical front of the wave-surface radiating from x has reached m, and a second wave-front of equal radius, $z'r$, has issued from z'. A part of this latter wave has, at the conclusion of this interval, been reflected from the concave mirror towards the focus z. Let the apertures at x and z' be then closed.



Next let the aperture at y be opened at the instant when the beams along xy and $z'y$ reach y, and be closed as soon as they have passed through y. They will pass through simultaneously, since $xy = z'y$.

Further, let the apertures z and x' be opened when the beam along xy reaches z, and let them be closed as soon as it has passed through z. The rays radiated from z', which were reflected from the concave mirror, will be brought to a focus at z, and pass through that aperture simultaneously with the beam in the direction xy; for, by the properties of the ellipse, the total distance traversed by any such ray is equal to $nn' = xz$: hence the wave-fronts, starting from x and z' at the same instant, will reach z simultaneously.

We have now to consider what occurs at each of the apertures y and z during the interval while they are open.

While y is open, a beam from x, of length xm, passes through it toward B, and a beam from z', of equal cross-section and length, passes through it away from B. These beams are of equal cross-section, because the tangent at y makes equal angles with the focal radii zy and $z'y$. But these beams are not of equal intensity in case A and B are of equal temperature, because any plane aperture, such as that at z', does not radiate equally in all directions. The intensity of the radiation diminishes, according to the well-known law, as the cosine of the angle between the direction of the ray and the normal; i.e., the intensity is less in the ratio of $\cos yz'y'$ to unity: hence less heat has escaped at y than has passed through y toward B in the ratio just mentioned.

Now as to the quantities of heat passing through the aperture z. Let us for definiteness take the body B to be common air, enclosed in a capacious vessel whose interior walls are perfectly black. Such being the case, whatever be the intensity of the ray received through z in any given direction, the intensity of the ray simultaneously emitted through z will depend only upon the previous temperature of B, or, at most, only infinitesimally upon the intensity of the ray received. Such being the fact, the beam emitted from z in the direction of y' has the same intensity as that previously emitted from z' towards y. But the beam which is received at z by reflection from y' has a very different intensity from this, for it is the beam which was originally radiated from z' towards y'.

When, therefore, Mr. Fitzgerald says, that, "if heat can go into B in the direction $y'z$, there would be an escape of heat from B in the direction zy' as well as in the direction zy, and so, to the two quantities of heat coming into B, there would escape two equal quantities," I feel that either he has made a mistake, or he presumes upon the ignorance of the reader; and, to use his own inimitable emphasis, I may say that I am sure no American or other scientific man agrees with him; and I think I am justified in adding that no Irishman will agree with him either, including his own better self. To make this point still more evident, we have only to consider what occurs when the concave semi-ellipsoidal reflector without apertures at y and y' is used to transmit radiations alternately between z and z'. First let z be opened during an interval such that rays of a length $\frac{1}{4}nn'$ are emitted; then let both z and z' be closed for an equal interval; next let z' be opened for an equal interval. During this third interval, equal quantities of heat pass through z', towards and away from B; but is Mr. Fitzgerald now ready to re-affirm his untenable proposition that the quantities of heat received and lost in any arbitrary direction are equal? Whether he is willing to do so or not, these quantities are not in general equal, his hasty affirmation of their equality to the contrary notwithstanding.

In close connection with this, it is pertinent to inquire once more what difference there is between the equal quantities of energy which B has simultaneously emitted from and received through z'. The kind of energy we call heat exists in two forms, — radiant and non-radiant; the latter is often regarded as identical with molecular agitation. Radiant heat may be totally reflected regularly, as light is by a perfect reflector; it may be totally reflected irregularly, as light is at a white surface; it may be wholly absorbed, and the energy conducted or radiated away with a different wave-length, as light is at a black surface; it may be wholly transmitted, as light is by a transparent substance; or there may be any combination of these. It is sufficient for our purpose to suppose that the constitution of the body B is such that regular reflection does not occur at its surface, and that the absorption of the rays entering it takes place in its interior, as in a partially or completely transparent substance enclosed in a black vessel. Now, when the rays have been absorbed, as they must be under such circumstances before they can be radiated away from B, their energy exists in the non-radiant form. I have stated in my previous letter, that, "after the energy reaches B, the path by which it has arrived is of no consequence," and that the direction which the rays may have had in coming to B is immaterial to the question under discussion. I stand ready to re-affirm this proposition, and now do so. Mr. Fitzgerald evidently regards this statement as so unscientific as to merit no reply what-

ever, and as such a self-evident piece of stupidity as to render further discussion useless.

Mr. Fitzgerald further says that Professor Wood has pointed out my mistakes. Is he willing to say what mistakes? I am convinced that Mr. Fitzgerald has never read any criticism by Professor Wood which he is willing to indorse; but, since he has himself made reference to these criticisms, I now ask Mr. Fitzgerald to state which of Professor Wood's positions against me he regards as sound. I do not believe he can find one.

Mr. Fitzgerald is unable to find any excuse for me when I introduce the idea of a pencil of rays of infinitesimal angle, unless it be that I have overlooked the fact that the energy of such a pencil is infinitesimal. I beg leave to say that the excuse and the assumption are both entirely gratuitous on his part, and not in accordance with the facts. In the algebraic investigation made in the original paper, as well as in that given above, the angle is not assumed to be infinitesimal, or even small. The sole excuse, and the real one, was that it was a form of argument which it seemed to me would put in a clear light the truth which I had otherwise established, that such a process as had been proposed would heat *B* at the expense of *A*.

In conclusion I may be permitted to say, that when Mr. Fitzgerald attempts to treat the controversy which he has himself inaugurated as not worth his consideration, and gives notice that he therefore thinks it not worth while to continue it, he must know that he lays himself open to the suspicion that poverty of arguments, and not disinclination to controversy, leads him to this decision. If Mr. Fitzgerald regards it as compatible with his dignity to beat a retreat on any such pretext, I, for one, cannot agree with him. H. T. EDDY.

Cincinnati, June 10.

Temperature of the spheroidal state.

In some experiments made to determine this point, to avoid radiation, the temperature was measured by a thermo-electric couple, as in Mr. Hesehus's studies. The element used was composed of german-silver and iron, No. 22 wire. The wires were hard soldered together, and then bent into a loop, and inserted in a glass tube filled with plaster-of-Paris. The tube was about twelve centimetres long and five millimetres bore; and the polished loop projected about eight millimetres, with a width of four millimetres. This element was connected directly with a reflecting galvanometer with twenty-five ohms in circuit. The spheroids were formed in a spoon heated over a spirit-lamp, and no special precautions were taken to secure equal temperatures. The loop was plunged in the spheroid, and deflection noted. Ten readings were thus taken with very small variations, and then the loop was placed in a beaker of water almost in contact with the bulbs of two thermometers. The water was then heated till the deflection was the same as that given by the spheroid, and the thermometers were read at this point both while heating and cooling. The variations of temperature were less than 1°; and this part of the experiment was repeated several times. The whole experiment was repeated a number of times on different days, with results all within 1°.

The temperature thus found was, for water, 90°, and for alcohol, 69°.

The size of the spheroid had no effect on the temperature, as the deflection remained constant as long as there was enough liquid to protect the loop from radiation. In the case of alcohol, the globule could be surrounded with vapor-flames until greatly reduced in size, without visibly increasing the deflection. Ether was experimented on; but the temperature proved to be so low, barely above that of the room, that no satisfactory results could be obtained.

The series of experiments hints at a lower and less variable temperature than has usually been assigned to the spheroidal state. LOUIS BELL.

Dartmouth college, June 9.

The inventor of the vertical camera in photography.

In *Science*, No. 70, Mr. G. Brown Goode says, concerning the invention of the vertical camera, "As a matter of fact, the vertical camera now used for photographing natural-history specimens, etc., is the outcome of a suggestion made in December, 1869, by Professor Baird."

As this letter is written to put on record the history of the invention of the vertical camera, it is necessary, in justice to myself and other inventors of a vertical camera, to state that the notes concerning the history of the invention were omitted from my original article (*Science*, No. 62) at the suggestion of the editor. The facts concerning the invention and use of the vertical camera known to me at present are as follows: —

In 1863 J. Gerlach published 'Die photographie als hilfsmittel zu mikroskopischer forschung,' in which was figured and described a vertical camera. In 1866 Montessier, in 'La photographie appliquée aux recherches micrographique,' described and figured a very much improved vertical camera. Both of these are figured and described in Frey, 'The microscope and microscopical technology' (New York, 1872). In 1872 John C. Moss invented a swinging vertical camera, which was described and figured in the U. S. patent-office report, October, 1877, p. 961, plate page 279. This camera was also figured in the *Scientific American* (1877) and in *Leisure hours* (1879). In 1877 also appeared a description and figure of a vertical camera by Schaefer, in 'The microscope and histology,' p. 295. The above, together with the letter of Mr. Goode, the note concerning Dr. Dannadieu's camera, and the papers by myself, constitute, so far as I know, all the published notices of a vertical camera.

By the courtesy of the gentlemen named below, I am enabled to make important additions to the history of this subject. John C. Moss, president of the Moss engraving company, in a private letter, says, "I remember having used a camera in a vertical position in 1858 to copy daguerrotypes and tintypes. . . . I also used the same arrangement to photograph some shells and other small objects." Dr. Deecke says, "I have used the camera in a vertical position since 1873. The simple alterations on the camera were devised by myself, and executed in the shops of the asylum." Prof. E. Ramsey Wright, of Toronto university, also uses a vertical camera; but the date of its invention by him is not known to me. To briefly summarize: the first figure and description of a vertical camera known to me were those of Gerlach, in 1863; while the first to use the vertical camera was John C. Moss, in 1858. Every person using this instrument, so far as appears at present, was *an* originator, but John C. Moss, seems to have been *the* originator, of the idea of a vertical camera.

SIMON H. GAGE.

Ithaca, June 21.

CHARLES ADOLPH WURTZ.

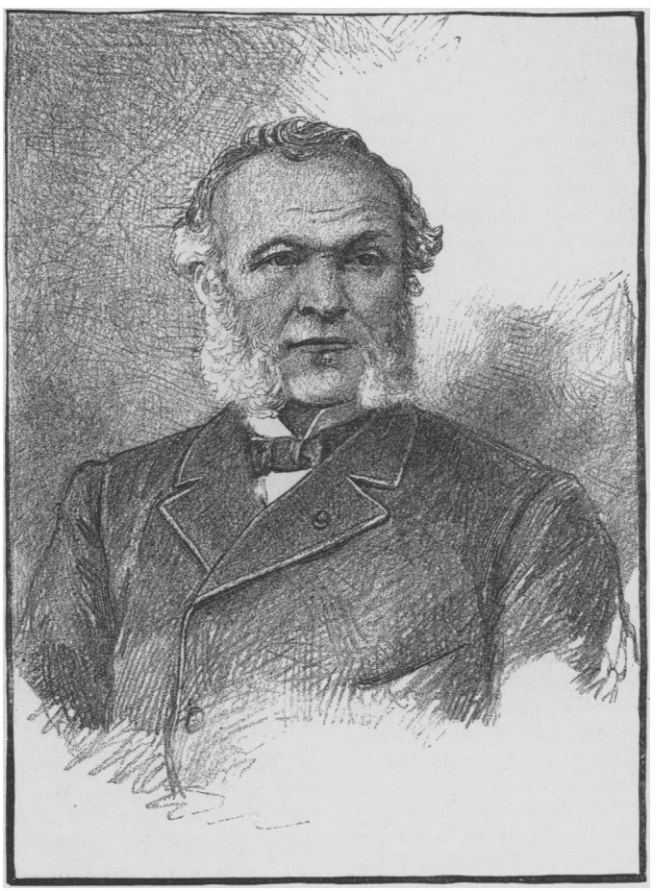
The subject of this sketch, Charles Adolph Wurtz, who died on the 12th of May at Paris, was the chief representative in France of what is generally known as modern chemistry. He was born November 26, 1817, at Strassburg. Here he began his studies, and received the degree of doctor of medicine. Before his graduation in medicine, he was made assistant in the chemical department in the medical faculty; in 1845 he became assistant in Paris; in 1846 he was made chemical director of the School of art and manufactures; in 1851 he became professor in the Agronomic institution of Versailles; and in 1854, after the death of Orfila, he was elected professor of medical chemistry, taking upon himself the duties connected with the chair of pure chemistry, up to that time held by Dumas, and that of toxicology. In 1866 he was made dean of the medical faculty,—a position which he held until 1875, when he became professor of organic chemistry in the faculty of sciences.

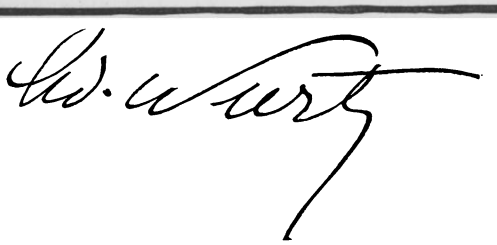
Wurtz's contributions to chemistry are numerous and important. He is fairly entitled to be counted among those who have originated and developed the views which are now held by the majority of chemists. The two hypotheses which at the present day form the basis of speculation concerning chemical phenomena, are, 1°, the hypothesis of Avogadro, according to which equal volumes of all gases contain the same number of molecules; and, 2°, the valence hypothesis, according to which the elementary atoms differ among each other as regards the number of atoms of other elements which they can hold in combination. Thus we have the compounds represented by the formulas, HCl, H_2O, and H_3N, in which the atoms of chlorine, oxygen, and nitrogen are represented in combination with one, two, and three atoms of hydrogen respectively. Before these differences among the elements were recognized, the existence of various types of compounds was observed. In a vague sort of way, compounds were referred to this or that type: gradually, however, the idea of types became more definite, and then, undoubtedly, exerted a great influence on the development of chemistry; leading directly, as it did, to the conception of valence. The first important investigation of Wurtz had much to do with giving definiteness to the conception of types. In the paper containing the results of the investigation, he described certain compounds, which he regarded as ammonia, in which one of the parts of hydrogen was replaced by complex groups containing carbon and hydrogen; as, CH_3 (methyl) and C_2H_5 (ethyl). Representing ammonia as $N\left\{\begin{matrix}H\\H\\H\end{matrix}\right.$, the new substances can be represented thus, $N\left\{\begin{matrix}CH_3\\H\\H\end{matrix}\right.$, $N\left\{\begin{matrix}C_2H_5\\H\\H\end{matrix}\right.$, etc. It became clear that substances can be made which bear a very simple relation to ammonia; and a good experimental basis was furnished for referring these compounds to the ammonia type. In regard to this discovery, Kekulé, the distinguished German chemist, says, "The discovery of the bases corresponding to ammonia is indisputably the corner-stone of our present views."

It is an extremely interesting fact, that Liebig predicted the discovery ten years before it was made, in developing his views regarding the nature of the nitrogenous bases, the alkaloids; but the view that these bodies can be referred directly to ammonia in the sense in which Wurtz regarded them was not generally accepted by chemists until shortly after his discovery.

Another important investigation of Wurtz is that which led to the discovery of the so-called diatomic alcohols, the chief of which is glycol. Ordinary alcohol may be referred to the water type in the same way that Wurtz's bases are referred to the ammonia type; i.e., it may be regarded as water, $O\left\{\begin{matrix}H\\H\end{matrix}\right.$, in which one of the hydrogen atoms is replaced by the complex group, ethyl, C_2H_5. According to this view, which is founded upon experimental evidence, alcohol is represented by the formula, $O\left\{\begin{matrix}C_2H_5\\H\end{matrix}\right.$. In 1854 Berthelot's memoir on the fats and glycerine appeared. In this it was shown that glycerine acts in general like an alcohol, but that acids unite with it in three proportions. Wurtz suggested that just as ordinary alcohol may be regarded as derived from water as above indicated, glycerine may be regarded as derived from water as represented in the formula $O_3\left\{\begin{matrix}C_3H_5\\H_3\end{matrix}\right.$. In other words, ordinary alcohol is derived from water by the substitution of one group, C_2H_5, for one hydrogen atom in one molecule of water, $O\left\{\begin{matrix}H\\H\end{matrix}\right.$; whereas glycerine is derived from water by the substitution of one group, C_3H_5, for three atoms of hydrogen in three molecules of water, $O_3\left\{\begin{matrix}H_3\\H_3\end{matrix}\right.$. This led Wurtz to inquire whether,

in a similar way, there might not be alcohols derived from two molecules of water, $O_2 \begin{cases} H_2 \\ H_2 \end{cases}$, by substituting some group for two hydrogen atoms. He soon discovered the first member of this group of bodies, viz., glycol, which he showed to be a compound intermediate between ordinary alcohol and glycerine. He represented it by the formula, $O_2 \begin{cases} C_2H_4 \\ H_2 \end{cases}$. Probably the most important result of this discovery was the fact that the attention of chemists was directed to the differences between the radicals C_2H_5 in ordinary alcohol, C_2H_4 in glycol, and C_3H_5 in glycerine. In the first the radical takes the place of one atom of hydrogen, in the second one radical replaces two atoms of hydrogen, and in the third the radical replaces three atoms of hydrogen. Here, then, in the polyatomic radicals, we have the beginning of the conception of valence. Just as radicals exist which can replace one, two, or three hydrogen atoms, so similar differences exist between the elements. Regarding the discovery of glycol, Ladenburg, in his 'Entwickelungsgeschichte der chemie,' says, "Seldom has the discovery of a single body exerted such an influence on the development of chemistry, seldom has a single compound given rise to such a series of beautiful and useful investigations, as glycol."





The ideas suggested by the investigations on the substituted ammonias and the polyatomic radicals were followed up by Wurtz and others, and the result is the chemistry of to-day. Wurtz has been an active participator in all important discussions regarding fundamental matters, and has ably and vigorously defended the modern views against the attacks of Berthelot, St. Claire Deville, and others in France. One of the last of these discussions was carried on only a few years ago. It pertained to the question whether Avogadro's hypothesis is valid or not. Many of the most prominent French chemists refuse to accept it, and, in defence of their position, tauntingly refer to two or three apparent exceptions. The particular case which gave rise to the discussion referred to is that of chloral hydrate. Wurtz claimed that the reason why this compound does not conform to the hypothesis is, that, when heated, it breaks up into water and chloral. This his opponents strenuously denied. Both sides introduced very delicate and skilful experiments; but, as is usually the case, no final conclusion

was reached. Nevertheless, a large audience of chemists was interested and instructed by the discussion, and chemistry was benefited.

It would lead too far to attempt to give an account of all that Wurtz has done for chemistry. In addition to the epoch-making contributions mentioned, his synthesis of neurine, his methods for the synthesis of hydrocarbons and of the acids of carbon, his method for the transformation of sulphuric acids into phenols, and investigations on the condensation of aldehydes, are all worthy of much more than ordinary mention. He has also been a prolific writer of excellent books on chemistry, some of which are recognized as standards; and he has been an editor of journals of chemistry, his name being found at present on the title-pages of the *Annales de chimie et de physique* and the *Bulletin de la Société chimique*. The titles of his principal books are included in the following list: Sur l'insalubrité des résidues provenant des distilleries, 1859; Leçons de philosophie chimique, 1864; Traité élémentaire de chimie médicale, 1864–65; Leçons élémentaires de chimie moderne, 1866–68; the Dictionnaire de chimie pure et appliquée, which appeared in parts, beginning in 1868; Traité de chimie biologique, vol. i., 1880; and The atomic theory, one of the volumes of the International scientific series. His Elements of chemistry has been translated into English, and has reached a second edition in this country. His writings are clear, vigorous, and interesting. His fairness as a historian has been questioned; and it must be conceded that his enthusiasm occasionally led him to what calmer men are inclined to regard as incorrect judgment, expressed in strong language. One of his remarks, which naturally aroused the ire of the Germans, is the much-quoted phrase with which he introduced his dictionary: "La chimie est une science française: elle fut constituée par Lavoisier, d'immortelle mémoire."

In 1865, on the recommendation of the Academy of sciences, Wurtz was awarded the imperial biennial prize of twenty thousand francs. In 1867 he succeeded Pélouze as a member of the chemical section of the Academy of sciences. In 1878 he received the Faraday medal from the Royal society of England, on the occasion of his being invited to deliver the Faraday lecture before the English chemical society. In 1881 he was honored with an appointment as senator for life in the French senate.

Imperfect as this sketch is, it will at least serve to show that Wurtz occupied a commanding position among chemists of the present. His loss is a serious blow to science, and especially to the progress of chemistry in France. It will be hard to find a successor possessing his energy and ability. Dumas died a month ago, after having reached a good old age, and after he had ceased to work actively; and while, now that he is gone, we more clearly recognize his greatness, we can nevertheless more readily reconcile ourselves to his loss than to that of Wurtz, who seemed still to belong to the younger generation, capable of guiding others for years to come, and of adding to his former brilliant discoveries.

RESULTS OF DREDGINGS IN THE GULF-STREAM REGION BY THE U. S. FISH-COMMISSION.[1]

6. Evidences of the existence of light at great depths in the sea.

THE evidences of the presence of light and its quality and source at great depths are of much interest. At present very little experimental knowledge in regard to these questions is available. That light of some kind, and in considerable amount, actually exists at depths below two thousand fathoms, may be regarded as certain. This is shown by the presence of well-developed eyes in most of the fishes, all of the cephalopods, most of the decapod Crustacea, and in some species of other groups. In many of these animals, living in two thousand to three thousand fathoms, and even deeper than that, the eyes are relatively larger than in the allied shallow-water species; in others the eyes differ little, if any, in size and appearance, from the eyes of corresponding shallow-water forms; in certain other cases, especially among the lower tribes, the eyes are either rudimentary or wanting in groups of which the shallow-water representatives have eyes of some sort. This last condition is notable among the deep-water gastropods, which are mostly blind: but many of these are probably burrowing species; and it may be that the prevalent extreme softness of the ooze of the bottom, and the general burrowing habits, are connected directly with the absence or rudimentary condition of the eyes in many species belonging to different classes, including Crustacea and fishes. Such blind species usually have highly developed tactile organs to compensate for lack of vision.

Other important facts bearing directly, not only on the *existence*, but on the *quality*, of the light, are those connected with the coloration

[1] See *Science*, Nos. 16, 19, 27.

of the deep-sea species. In general, it may be said that a large proportion of the deep-sea animals are highly *colored*, and that their colors are certainly *protective*. Certain species, belonging to different groups, have pale colors, or are translucent, while many agree in color with the mud and ooze of the bottom; but some, especially among the fishes, are very dark, or even almost black; most of these are probably instances of adaptations for protection from enemies, or concealment from prey. But more striking instances are to be found among the numerous brightly colored species belonging to the echinoderms, decapod Crustacea, cephalopods, annelids, and Anthozoa. In all these groups, species occur which are as highly colored as their shallow-water allies, or even more so. But it is remarkable that in the deep-sea animals the bright colors are almost always shades of orange and orange-red, occasionally brownish red, purple, and purplish red. Clear yellow, and all shades of green and blue colors, are rarely, if ever, met with. These facts indicate that the deep sea is illuminated only by the sea-green sunlight that has passed through a vast stratum of water, and therefore lost all the red and orange rays by absorption. The transmitted rays of light could not be reflected by the animals referred to, and therefore they would be rendered invisible. Their bright colors can only become visible when they are brought up into the white sunlight. These bright colors are therefore just as much protective as the dull and black colors of other species.

The deep-sea star-fishes are nearly all orange, orange-red, or scarlet, even down to three thousand fathoms. The larger ophiurans are generally orange, orange-yellow, or yellowish white; the burrowing forms being usually whitish or mud-colored, while the numerous species that live clinging to the branches of gorgonians, and to the stems of Pennatulacea, are generally orange, scarlet, or red, like the corals to which they cling. Among such species are Astrochele Lymani, abundant on the bushy orange gorgonian coral, Acanella Normani, often in company with several other orange ophiurans belonging to Ophiacantha, etc. Astronyx Loveni and other species are common on Pennatulacea, and agree very perfectly in color with them. These, and numerous others that might be named, are instances of the special adaptations of colors and habits of commensals for the benefit of one or both. Many of the large and very abundant Actiniae, or sea-anemones, are bright orange, red, scarlet, or rosy in their colors, and are often elegantly varied and striped, quite as brilliantly as the shallow-water forms; and the same is true of the large and elegant cup-corals, Flabellum Goodei, F. angulare, and Caryophyllia communis, — all of which are strictly deep-sea species, and have bright orange and red animals when living. The gorgonian corals of many species, and the numerous sea-pens and sea-feathers (Pennatulacea), which are large and abundant in the deep sea, are nearly all bright colored when living, and either orange or red. All these Anthozoa are furnished with powerful stinging-organs for offence and defence; so that their colors cannot well be for mere protection against enemies, for even the most ravenous fishes seldom disturb them. It is probable, therefore, that their invisible colors may be of use by concealing them from their prey, which must actually come in contact with these nearly stationary animals, in order to be caught. But there is a large species of scale-covered annelid (Polynoë aurantiaca Verr.) which lives habitually as a commensal on Bolocera Tuediae, a very large orange or red actinian, with unusually powerful stinging-organs. Doubtless the worm finds, on this account, perfect protection against fishes and other enemies. This annelid is of the same intense orange color as its actinian host. Such a color is very unusual among annelids of this group, and in this case we must regard it as evidently protective and adaptive in a very complex manner.

It has been urged by several writers, that the light in the deep sea is derived from the phosphorescence of the animals themselves. It is true that many of the deep-sea Anthozoa, hydroids, ophiurans, and fishes are phosphorescent; and very likely this property is possessed by members of other groups in which it has not been observed. But, so far as known, phosphorescence is chiefly developed in consequence of nervous excitement or irritation, and is evidently chiefly of use as a means of defence against enemies. It is possessed by so many Anthozoa and acalephs which have, at the same time, stinging-organs, that it would seem as if fishes had learned to instinctively avoid all phosphorescent animals. Consequently it has become possible for animals otherwise defenceless to obtain protection by acquiring this property. It is well known to fishermen that fishes avoid nets, and cannot be caught in them if phosphorescent jelly-fishes become entangled in the meshes: therefore it can hardly be possible that there can be an amount of phosphorescent light, regularly and constantly evolved by the few deep-sea animals having

this power, sufficient to cause any general illumination, or powerful enough to have influenced, over the whole ocean, the evolution of complex eyes, brilliant and complex protective colors, and complex commensal adaptations.

It seems to me probable that more or less sunlight does actually penetrate to the greatest depths of the ocean in the form of a soft sea-green light, perhaps at two thousand to three thousand fathoms equal in intensity to our partially moonlight nights, and possibly at the greatest depths equal only to starlight. It must be remembered that in the deep sea, far from land, the water is far more transparent than near the coast. A. E. Verrill.

ALPHONSE LAVALLÉE.

Dendrological science has met with a great, an almost irreparable loss, in the death of Alphonse Lavallée, the best-known and most successful student and collector of trees of this generation. Twenty-five years ago, under the advice and inspiration of Decaisne, he commenced to gather upon his estate at Segrez, near Paris, the collection of trees and shrubs which has since developed into the richest and most complete arboretum ever established.

Mr. Lavallée did not confine himself merely to the collection and cultivation of trees: he studied them thoroughly and critically, publishing from time to time the results of his investigations.

The nomenclature and synonymy of the forms and varieties of many genera of trees cultivated in the different countries of Europe, long ago fell into an almost hopeless confusion; and, to bring some order out of this confusion, Mr. Lavallée set himself resolutely to work. The results of these investigations were published, ten years ago, in the catalogue of his collections. A second and greatly enlarged edition of this useful work, written with a riper judgment and fuller knowledge, in many critical questions of synonymy, was nearly ready for the printer at the time of Mr. Lavallée's death. He had commenced, too, the publication of the *Arboretum Segrezianum*, of which, however, only five parts had appeared. This sumptuous work, superbly illustrated with figures engraved from steel, contained the descriptions and history of some of the rarest or least-known plants of Mr. Lavallée's collections. His latest published work, a magnificently illustrated folio in which are described *Les clématites à grandes fleurs*, has only just reached the author's correspondents in this country. This was to be followed, in the course of the year, by an illustrated monograph of the genus Crataegus, which has long occupied Mr. Lavallée's attention. His collection of different forms of the species of this most difficult and perplexing genus was unsurpassed, and his opportunities for observing them in a living state unequalled; so that a valuable revision of this genus might have been looked for from his pen.

Mr. Lavallée, at the time of his death, was president of the Central horticultural society of France, and perpetual treasurer of the National agricultural society, and had just declined the professorship in the Museum d'histoire naturelle, lately made vacant by the death of his old master, Decaisne. He had been in ill health for several months, but his death was entirely unexpected. It was caused by aneurism, and occurred at Segrez upon the 3d of May, only a few hours after his return from a long residence in the south of France. Mr. Lavallée was only forty-nine years old at the time of his death. C. S. S.

BURIAL-MASKS OF THE ANCIENT PERUVIANS.

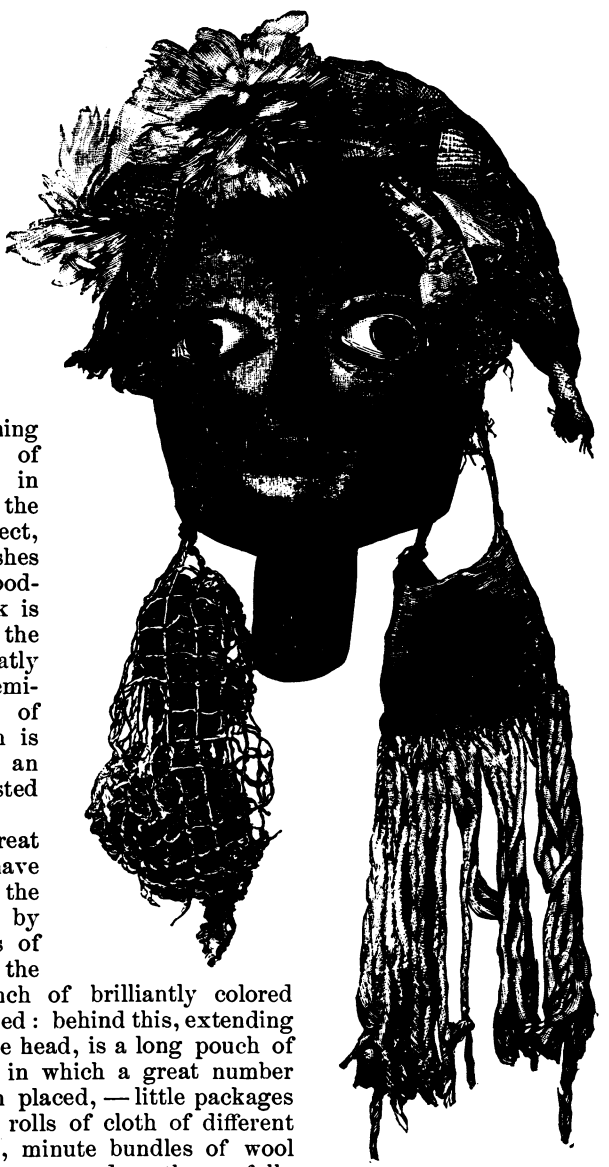
A recent contribution to the Bureau of ethnology illustrates one of the most curious of ancient burial customs. It is almost a universal practice with primitive peoples to deposit articles of value with the dead. The ancient Peruvians were most lavish in this respect. Food, raiment, implements, utensils, rich tapestries, and precious articles of silver and gold, as well as objects of superstitious regard, were freely sacrificed.

Most interesting of all these offerings were the mask-like heads generally placed within the outer wrappings upon the top of the mummy pack. At Ancon these objects were usually made of cotton cloth. A small square sack or pillow was made, and stuffed with leaves or seaweed. One side was painted to represent the human face, and to this a wooden nose was stitched. Hair was attached to the back of the head, and a more or less elaborate head-dress was placed upon the crown.

The specimen referred to is of this class. It was obtained from a grave in the vicinity of Lima, and purchased by G. H. Hurlbut of Chicago. It differs greatly from Ancon specimens, but is somewhat similar to an example illustrated by Squier, also from the vicinity of Lima. It is interesting chiefly on account of the heter-

ogeneous collection of ornaments and trophies with which it is bedecked.

The head is of heroic size, the face only being made of wood. This is strongly carved, having a prominent nose, and wide, firm mouth. The eyes are formed by excavating oval depressions, and setting in pieces of shell. First, oval pieces of white clam-shell are inserted, which represent the whites of the eyes: upon these, small circular bits of dark shell are cemented, forming the pupils. Locks of hair have been set in beneath the shell, the ends of which project, representing the lashes of the eye. The wooden part of the mask is flat behind; but the head has been neatly rounded out by a hemispherical bundle of dried leaves, which is held in place by an open net of twisted cords.



Besides this, a great variety of articles have been attached to the margin of the mask by means of five pairs of perforations. Upon the crown a large bunch of brilliantly colored feathers had been fixed: behind this, extending across the top of the head, is a long pouch of coarse white cloth, in which a great number of articles had been placed, — little packages of beans and seeds, rolls of cloth of different colors and textures, minute bundles of wool and flax, bits of copper and earth carefully wrapped in husks, bundles of feathers, etc. Encircling the forehead are long, narrow bands or sashes, one of which is white, the others having figures woven in brilliant colors. The ends of these hang down at the sides of the face.

Attached to the left side of the mask by long stout cords is a pouch resembling a tobacco-bag, about six inches square, the fabric of which resembles a coarse sail-cloth: attached to the lower part of this is a fringe of long, heavy cords. From the opposite side of the head, a net was suspended in which had been placed a variety of objects, — a sling made of cords very skilfully constructed; bundles of flax and cords; small nets containing beans, gourd-seeds, and other articles; copper fish-hooks still attached to the lines, which are wound about a bit of corn-stalk or cane; neatly made sinkers of dark slate wrapped in corn-husks; together with many other curious relics.

These articles were doubtless the property of the departed, so placed in accordance with the established customs of the race to which he belonged. The mask-head was probably in itself an object of much consideration; although we are at a loss to determine its exact use by the living, or its significance as a companion of the dead.

W. H. HOLMES.

MEETING OF THE CIVIL ENGINEERS AT BUFFALO.

THE annual convention of the American society of civil engineers was held in Buffalo, June 10–13, and will be remembered by all who attended as one of the most successful in the history of the society. A spe-

cial train, courteously tendered by the management of the New York, West-Shore, and Buffalo railroad, left New York on the morning of June 9, carrying a large number of members from the eastern states, while many more came from other directions; the total number present, including guests, being between three and four hundred. At the opening meeting, on Tuesday, June 10, the reading of papers was begun; and many of great interest were presented at this and the following sessions. Mr. James B. Francis of Lowell, past president of the society, presented one describing some tests, made under his direction, to determine the efficiency of a Humphrey turbine water-wheel of large power (about 275-horse power), lately put into one of the mills of the Tremont and Suffolk manufacturing company at Lowell. The test showed an efficiency of about eighty-two per cent, which was considered satisfactory. Mr. Francis also presented a paper giving the results of a large number of experiments, which he had made in connection with this turbine test, to determine the coefficients of the formula for the flow of water over a submerged weir, or one in which the level of the water on the down-stream side is above the crest of the weir. Experiments on weirs of this kind have not been very numerous, especially with large quantities of water. The maximum quantity in Mr. Francis's experiments had been somewhat over two hundred cubic feet per second, and his paper gave the proper constants to be used in the ordinary formula for cases of this kind. His results must be considered as of great value, and as forming a worthy supplement to his former extended experiments on ordinary weirs.

Mr. A. M. Wellington read a paper on a line of railroad which he had located from Vera Cruz to the City of Mexico, comparing it with an existing line built some time ago. Although the elevation surmounted was the same in both cases (about 8,050 feet), the old line had a grade of 216 feet per mile for most of the distance, and had cost over three times the estimated cost of the new line, which had a continuous grade of 106 feet to the mile for a distance of about eighty miles, broken in but one place by a level stretch of half a mile, at an important station. This is probably the longest unbroken grade in the world. The maximum curvature was about the same in both lines, though rather sharper in the case of the new line, where the smallest radius was about 300 feet.

Mr. P. C. Asserson of Norfolk gave the results of his experiments in endeavoring to protect wood from the ravages of the Teredo navalis. He had tried some twenty different preservatives, both paints and substances to be injected into the wood, and had found nothing effective except creosote. Leaving the bark on piles, or incasing them in a sheathing of plank, was also stated to be effectual, as the Teredo could not cross a seam, and therefore could not penetrate the pile under these circumstances. In the discussion on this paper it was stated that covering piles with yellow metal had proved effectual, as the animal would not pursue its ravages within the distance so covered, even though it might be able to gain access to the wood on either side of the metal. It was therefore only necessary to cover piles with the metal down to the mud bottom, or a little farther. Driving small-headed nails thickly all over the surface of the pile was also said to have preserved piles for over seventy years, by preventing the entrance and growth of the animal.

Mr. Robert Moore of St. Louis described the landing arrangements for a car-ferry across the Mississippi River at St. Louis. The ordinary range of the water being about thirty-one feet, and the current very swift, the problem had presented some difficulty; and it had been necessary to protect the bank of the river, for some distance above and below, by willow mattresses sunk with stone in the ordinary way. The details of the arrangement adopted were shown by drawings.

Mr. D. Fitzgerald of Boston read a paper on the rainfall at Lake Cochituate, discussing the results of observations extending from 1852 to the present time. His results differ somewhat from those obtained by Mr. Schott, in his work on rainfall, published among the Smithsonian contributions, on account of the longer period at the command of Mr. Fitzgerald.

The application of the water-power of Niagara to the generation of electricity was the subject of an interesting paper by Mr. Benjamin Rhodes of Niagara Falls. He estimated the average power as seven million horse-power, on the total fall, including the rapids above, of two hundred and thirty feet; and the cost of the plant necessary to utilize this power, transform it into electricity, and transmit it anywhere within a radius of five hundred miles, was placed at five thousand million dollars. About six thousand horse-power is now in use at the falls, the greater part on the hydraulic canal, which takes the water from the extreme head of the rapids, and discharges it below the falls, using it on the wheels under heads of from fifty to a hundred feet. Water-power has been used to run a Brush dynamo since 1879, for lighting the grounds of Prospect Park. The speaker calculated that there would be a saving per light, at the city of Buffalo, by using the Niagara water-power instead of steam-power, of forty dollars per annum. The well-known advantages of the water-power at Niagara, as regards steadiness, etc., were dwelt upon.

Capt. O. E. Micharles, U.S.A., discussed the heavy-gun question, taking the ground that it would be better for the government to make large contracts with private establishments for the manufacture of heavy cannon, than to establish a government foundry for their manufacture, and advocating the employment of a Rodman gun, cast from open-hearth steel, annealed from the interior.

The most important business action taken by the society was a vote to memorialize the president of the United States, asking that the president of the society be appointed a member of the international conference to meet at Washington in October next, to fix and determine a prime meridian from which time should be reckoned. The committee on standard

time reported that a great majority of those whose opinions had been sought had expressed themselves in favor of a consecutive numbering of the hours of the day from 1 to 24.

At the evening session on Tuesday, June 10, the society were welcomed to Buffalo by the city officers; and the president of the society, Mr. D. J. Whittemore, delivered the annual address. On Wednesday an excursion was made to the so-called Tifft farm, where improvements are being made, designed to facilitate the transfer of coal from the railroads to the lake vessels. They will consist in an extensive system of docks, excavated on the mainland, together with coal-pockets and other structures for loading into the boats. Near by, an extensive storage-place for coal is provided; the loaded cars being drawn up a long incline of trestle-work, from which they descend by gravity after unloading their coal beneath. The mountain of coal thus formed is penetrated by a wooden tunnel eight feet square, into which cars are run and loaded through sliding doors, when the coal is to be transported to the pockets at the docks. At this place a hundred and twenty thousand tons of coal may be stored during the season, when navigation is closed, or from Dec. 1 to May 1. Although the dock frontage of Buffalo already measures five miles, the Tifft farm improvements will add eight miles more, at an estimated cost of eighty dollars per foot front. The unloading and loading facilities are already so complete at Buffalo, that a two-thousand ton vessel may arrive loaded with grain, and depart loaded with coal, within eighteen hours. There is a growing demand, however, for greater capacity as the lake traffic increases.

Thursday was devoted to an excursion to Niagara Falls and the new cantilever bridge, and on Friday the reading of papers was resumed. Mr. E. L. Corthell, chief engineer of the West-Shore railroad, and formerly in charge of the works at the mouth of the Mississippi, read a paper on the South-Pass jetties, dwelling chiefly upon the lessons which had been taught by their construction. The channel is now nearly straight for two and a quarter miles, and the depth is continually increasing. A survey made last May showed the least depth through the channel to be forty feet except in a few places, and everywhere much in excess of that guaranteed by the contract. Moreover, the jetties had now become thoroughly embedded in the sand, which had become firmly packed into all their interstices, so that their permanence was assured. There was, further, no advance of the bar toward the gulf, although a rapid advance had been predicted by many engineers. The effect on commerce had been very great, and there was now no delay whatever at the mouth of the river; so that New Orleans might be said to have a better channel from the ocean than any other city in America. The results of the work had clearly proved the advantage of a concentration of the force of the current, and had shown that the river could obtain what it could maintain, and that it could not maintain what it could not obtain. Altogether, the result of the works had been in every way satisfactory.

A paper by Mr. Benjamin Reese, on the management of forces engaged in railroad-track repairs, was listened to with evident appreciation by the railroad engineers present.

Mr. E. Sweet, state engineer of New York, contributed a paper on the enlargement of the Erie Canal, arguing, that, in order to be a proper highway, the canal should be large enough to carry the largest lake vessels, or eighteen feet deep and a hundred feet wide on the bottom, with locks four hundred and fifty feet long and sixty feet wide. The cost of the improvements proposed, which would involve a relocation of part of the canal, and the canalization by locks and dams of the Mohawk River, as well as some works on the Hudson, was estimated at from a hundred and twenty-five to a hundred and fifty million dollars; while the probable tonnage was placed at twenty to twenty-five million tons per annum. Thirty years ago the Erie Canal carried nine-tenths of all the traffic between Buffalo and New York, while now it carries less than one-fifth of the total. The paper was followed by one prepared by Capt. Drake of Buffalo, urging the importance and the cheapness of water-carriage.

Mr. J. J. R. Croes of New York read a paper, comparing the water-rates in a large number of cities and towns. Assuming the conditions of a dwelling for seven persons, he found that the rates would vary in different towns from five dollars to seventy-two dollars per annum, and that they were by no means in proportion to the cost of the works. The average rates in different parts of the country were compared, and the advantages of measuring the water delivered to consumers were discussed.

The remainder of the session was devoted to a discussion on the subject of steel, and a comparison between steel and iron for structural purposes; but, on account of the want of time, a number of papers were read by title only.

RECENT OBSERVATIONS ON EXPLOSIVE AGENTS.

JUDGING from the many attempts made to vary the form and composition of 'explosive gelatine,' this method of using nitroglycerine is meeting with favor. As invented by Nobel, it is made by dissolving seven parts of soluble gun-cotton in ninety-three parts of nitroglycerine at a temperature of 35° C. Under the circumstances, the whole mass gelatinizes, and, when cool, is quite a stiff and translucent jelly, insoluble in water, quite insensible to shocks, and holding its nitroglycerine firmly. Unfortunately its stability has become a matter of doubt. Hill, Gen. Abbot, and others have cited instances of spontaneous decomposition during storage; and the writer has recently described the circumstances attending a similar case occurring under his own observation. The cause is believed to exist in the lack of uniformity of composition of the gun-cotton, and the failure to remove from it the last traces of free acid. It is hoped that these difficulties may be overcome.

The variations from the above composition have consisted in varying the proportions given, in the addition of camphor, benzene, and the like substances to increase the insensibility, and of oxidizing and combustible agents to cheapen the cost and modify the force of the explosive. The widest departure from the original explosive gelatine is probably found in the substance styled 'forcite,' invented by J. M. Lewin. This is made by subjecting finely powdered paper stock, or other form of cellulose, to the action of high-pressure steam until the cellulose is converted into a gelatinous mass. This is then cooled and immersed in water, where it preserves its gelatinous form indefinitely. Seven parts of this gelatinized cellulose, seventy-five parts of nitroglycerine, and eighteen parts of nitre are incorporated together over a water-bath at a temperature of 40° C. The result is a whitish, opaque, gelatinous mass. The ingredients are varied by substituting dextrine and ordinary cellulose for a part of the gelatinized cellulose. Judging from some of the descriptions of this powder, various coloring-matters are also used. It is claimed for this explosive, that while it is stable, and holds its nitroglycerine so firmly that it is not separated by sulphuric ether, alcohol, or water, and while it burns in the open air without explosion, yet it may be exploded in a drill-hole by ordinary fuses. Three factories are now producing this explosive in Europe, and one has recently been started on a very extensive scale in New Jersey. These last works are stated to have a capacity of five tons of powder per day. A novelty in these works is the use of India-rubber pipes laid underground for conveying the nitroglycerine from the converting-house to the incorporating-houses.

Among the processes invented for making nitroglycerine, the one devised by Boutmy and Faucher seemed to offer the best assurance of safety, owing to the absence of all energetic action during the operation of conversion. In this process nitric and sulphuric acids were mixed together in equal proportions. A second mixture was then made, with one part of glycerine to three and two-tenths parts of sulphuric acid. When quite cooled, fifty-six parts of the first mixture were mixed in an earthenware vessel with forty-two parts of the second mixture, and allowed to remain from ten to twenty-four hours, when the nitroglycerine was found to have formed quietly, and collected more or less completely on the top of the acids. The failure of the nitroglycerine to separate completely and at once from the acids has been pointed out as a source of danger in the process, since nitroglycerine is decomposed through prolonged contact with strong acids. In spite of this, the process has been in use at the French government factory at Vonges since 1872, and but one accident is recorded. They dealt, however, with comparatively limited quantities, and used pure materials.

Probably the first attempt to apply the process on a commercial scale was made at Pembrey, in Wales, in 1882, where an iron converter was constructed for nitrating fifteen hundred pounds of glycerine in each charge. The process of mixing differed from that used at Vonges, in that, while the final mixing was done there by hand with a wooden paddle, at Pembrey the sulphoglycerine mixture was blown into the acid mixture in the form of a spray, while the acid mixture was being agitated by a blast of air. The process, as thus modified, had been in operation but a few months, when the converter, while containing from five hundred to six hundred pounds of nitroglycerine, was blown up. Col. Majendie has given an extended account of the circumstances in his report, No. 48, to the home secretary; and he considers the explosion due to violent chemical action, established in acid nitroglycerine present in the converter. Dr. Dupré, however, found the glycerine used to be contaminated with fatty acids, while no effort had been made to free the nitric acid from nitrous acid. This lack of care would have led to danger in any process.

Some years since, Dr. Sprengel proposed a convenient and safe way of forming explosives by using oxidizing and combustible agents of such a nature that they could be readily mixed at the place where wanted for use. Several such mixtures have been devised; among others, 'rackarock,' which consists of potassium chlorate and nitro-benzene, and which has given good results. For this explosive the chlorate is furnished in bags of suitable size; and, when wanted for use, these bags are immersed in the liquid nitrobenzene for a determined length of time, when they are ready to be exploded. The most recent explosive of this class, 'panclastite,' is composed of liquid nitrogen tetroxide and a combustible agent, preferably carbon disulphide, in the proportion of three volumes of the first liquid to two of the second. The heat developed by the combustion of this mixture is estimated at about 3000° C.; and, when burning freely, the light is so bright as to equal that of the calcium light. The inventor claims that its explosive power, when confined, surpasses that of dynamite; but the French explosive commission, when using Abel's lead cylinder test, obtained a slightly less value. With a mixture of equal volumes of nitrogen tetroxide and of nitrotoluene, however, they obtained the same value as for dynamite No. 1. Notwithstanding the power of the panclastite mixtures, it is questionable whether such a substance as nitrogen tetroxide can be brought into any general use.

While much attention has been given to the high explosives, the claims of gunpowder have not been overlooked; and many changes have been proposed in the form, size, shape, and density of the grain, and in the mode of manufacture and composition of the mixture. The most novel among these is the hydrocarbon-powder, made from a mixture of nitre or potassium chlorate with a solid hydrocarbon, such as paraffine, asphaltum, India-rubber, and the like. The incorporation is effected by the aid of a volatile liquid solvent, which dissolves the hydrocarbon, and furnishes a plastic mass, which may be moulded into any desired form, and then hardened by allowing the solvent to evaporate. A peculiar advantage claimed for the powder is its imperviousness to water.

A variety of gunpowder made by the Rottweil-

Hamburg powder company at Duneberg, is, however, attracting the most attention on account of the high initial velocities and low pressures which it has actually given in practice. The grains weigh about forty-two grams, have a specific gravity of 1.86, and have the hexagonal prismatic form so generally adopted in Europe, with one canal. They have the color of cocoa; and from this characteristic the powder has become known as 'cocoa' powder. The reddish hue seems to be due to red-burned charcoal. Powders heretofore made with red coal have been found to be readily inflammable, and to explode with dangerous brusqueness, producing high local pressures; and hence care has been taken to select only well-burned black coal for the manufacture of military gunpowders. In spite of the fact that 'cocoa' powder contains red coal, it has been found by experiment, that a grain of it burns slowly and with very slight deflagration, when ignited in the open air; and that a mass as great as fifty-five kilograms, when enclosed in a wooden box and ignited, burned slowly, without exploding, and simply raised the cover of the box without displacing it. This may be owing to the large percentage of charcoal, the low percentage of sulphur, and the high specific gravity; but the slowness of combustion is equally marked when a grain is crushed to meal-powder; and it is probable that there is a difference in the kind of charcoal, as well as in the quantity. In addition, it is claimed that this powder is but slightly hygroscopic, and yields very little smoke. The advantage of this last-mentioned property is shown by the recent experience at Alexandria, where the English were compelled from time to time to cease firing, to allow the smoke from their guns to clear away; and in the Sudan, where the English were blinded by the smoke, under which the enemy crept upon them. On the other hand, it is stated that 'cocoa' powder fouls badly.

With gunpowder, as with all mechanical mixtures, the uniformity of the product depends largely upon the thoroughness of the incorporation. To test gunpowder for this most important condition, it is customary to flash a quantity upon a plate of glass, and to examine the residue; but the deliquescent and perishable character of the deposit necessitates immediate examination, while long and frequent experience with the test is required in order to enable one to draw a proper conclusion from the observation. Col. Chabrier has proposed the use of paper, colored blue by starch and potassium iodide, upon which to make the flash, the color being discharged by the combustion of the powder. The test-papers of this process, however, are also evanescent, and the trained memory must be relied upon in reaching a decision. The writer has recently proposed the use of a paper colored with Turnbull's blue, such as is produced in the 'blue-print' process of photography; since the color of this paper is discharged by the action of such alkaline salts as are formed in the combustion of gunpowder. For use, the paper is dampened; the powder is placed upon it in a uniform heap, and then flashed. The paper is exposed to the action of the residue for half a minute, and then washed in running water, and dried. The result is, that, wherever a globule has rested, the color is bleached. It is believed that these spots will be smaller and more uniformly distributed as the incorporation approaches completeness, provided the state of the different samples tested is otherwise the same. These test-papers can be preserved without change, and may be filed as standards for comparison, or forwarded to experts for examination.

CHAS. E. MUNROE.

NOTICES OF ETHNOLOGIC PUBLICATIONS.

THE ethnology of the Eskimo, better called Innuit people, is to us of an ever-renewed interest, not only on account of the researches around the arctic pole, in the furtherance of which this race has been eminently helpful, but also for the peculiar ethnographic position of the people among the other American nations. Dr. Franz Boas has discussed the present seats of the Neitchillik-Eskimo, first seen by Sir John Ross (1829–33), and recently visited by Lieut. Schwatka, and illustrates his article by a topographic map.[1] Another article of singular interest, by Edward B. Tyler, deals with "Old Scandinavian civilization among the modern Eskimos," with two plates,[2] and contains a large amount of facts new to science. Bering's Straits, considered as the 'bridge' between the two continents and hemispheres, necessarily calls the attention of all ethnologists to the tribes inhabiting both sides of it. The ethnographic relations of these are expounded with minute care by Prof. G. Gerland of the Strasburg university, in a paper inscribed "Zur ethnographie des äussersten nordostens von Asien."[3] The tribes on the Asiatic side are described from the accounts given by the latest travellers, and old errors concerning them are refuted.

Rev. J. Owen Dorsey, formerly missionary among the Ponka Indians, and a specialist in the study of all tribes and languages of the Dakotan family, has given a lucid 'account of the war customs of the Osages'[4] as the result of a visit to that tribe, made in 1883. These interesting war and hunting customs are chiefly based upon the gentile or totem-clan system. The rules observed in encamping and other military acts were most rigidly and unalterably enforced, perhaps more so than our own military regulations, and through their archaic forms testify to a high antiquity. Customs like these may be traced among all the warlike tribes of the Mississippi plains, even at the present time, when they are hedged in within the narrow limits of Indian reservations. Numerous illustrations facilitate a clearer understanding of the practices described.

Dr. W. J. Hoffman presents us a "Comparison of Eskimo pictographs with those of other American aborigines,"[5] interspersing his article with numerous

[1] *Zeitschr. gesellsch. erdk. Berlin*, xviii. 222.
[2] *Journ. anthrop. inst.*, 1884, 348.
[3] *Zeitschr. gesellsch. erdk. Berlin*, xviii. 194.
[4] *Amer. nat.*, 1884, 113.
[5] *Trans. anthrop. soc. Wash.*, ii. 128.

illustrations and linguistic scraps. Another paper,[1] by A. S. Gatschet, discusses his ethnologic and linguistic observations made among the Shetimasha Indians of St. Mary's parish, La.

Ethnologic results of a visit, made in 1883, to two Iroquois reservations in New-York state, are published in French and in Dutch by Dr. H. ten Kate, who in the same year made somatological and other researches among the Indians of the south-west of the United States and the north-west of Mexico, including the peninsula of California.

Wood-carvings of the Haida and other tribes of the north-west coast of North America are figured upon thirteen splendidly colored plates, with descriptive letter-press, in a folio volume entitled 'Amerikas nordwestküste; neueste ergebnisse ethnologischer reisen.' The objects represented consist of masks of human and animal shape; of implements, such as spoons, vases, rattles; of troughs, posts, idols, and other wood-carvings, — all of which are now exhibited in the collection of the Berlin royal museum. This folio was published by Asher & Co., in Berlin, under the auspices of the direction of the ethnologic department in the museum in 1883 (Dr. Adolf Bastian); and an English edition was issued in the same year.

The political and social condition of the Liberian negroes, an immigration from North America into western Africa, is discussed in a long and very elaborate article read to the Geographical society of Berne, Switzerland.[2] The capital of this Ethiopian republic is Monrovia: the population consists of two elements quite distinct from each other, — the aboriginal negroes and the immigrated settlers. Slavery is nominally abolished by the constitution of the republic; but a substitute has been found in the so-called 'bushniggers,' whose only toilet consists in a handkerchief worn about their loins. The Liberia constitution proclaims full liberty of religion, conscience, of speech and press, and gratuitous education of children; and one of the more noticeable paragraphs precludes white people from acquiring any real estate, and from being intrusted with any public office. J. Bütikofer, the author of the article, gives many observations and personal experiences from his travels in the interior and on the coast of Liberia.

An excellent ethno-archeological publication on Bavaria, which deserves more than a passing notice, is published under the title, 'Beiträge zur anthropologie und urgeschichte Bayerns.' These contributions are the organ of the Munich society of anthropology, ethnology, and prehistorics, being issued in four numbers to a volume of lexicon-octavo size, and profusely illustrated. Under the editorship of Joh. Ranke and Nic. Rüdinger, five volumes have been issued up to the present year. The most extensive and difficult topic now engrossing the attention of that scientific body is the publication of the archeologic map of Bavaria, — a land which covers an area of 75,000 □ kilometres, and has been in its more level parts thoroughly explored by archeologists for remains of antiquity. Of the fifteen sheets of the map, five have been issued by the editor in charge, Prof. F. Ohlschlager, who uses over twenty colored sign-marks for the objects discovered, and adds a statistical and topographic register of the finds. The occurrence of all the 'hochäcker,' a relic analogous to the 'gardenbeds' of the American north-west, has been represented on a separate map in the fifth volume: they are almost entirely limited to the southern parts of Bavaria, extending between Augsburg and Salzburg.

[1] *Trans. anthrop. soc. Wash.*, ii. p. 148.
[2] *Jahresb. geogr. gesellsch. Bern*, v. 75.

MENTAL EVOLUTION IN ANIMALS.

Animal intelligence. By GEORGE J. ROMANES. New York, *Appleton*, 1883. (International scientific series.) 498 p. 8°.

Mental evolution in animals. By the same. New York, *Appleton*, 1884. 384 p. 8°.

IN the wide range of interesting facts collected and published a year ago in 'Animal intelligence,' Mr. Romanes laid a broad foundation for his present work, 'Mental evolution in animals;' and these volumes, we find, are preliminary to a forthcoming work upon 'Mental evolution in man,' which will complete the most extensive study of comparative psychology ever attempted. This subject has not hitherto received the comprehensive treatment which its importance deserves. One of the most vital questions of our times is the genetic continuity of the mind as well as the physical structure of man with that of the lower animals: it marks the point where the views of Darwin and Wallace, and of many of their followers, diverge; and, whatever our own opinions may be, we must regard this as the crowning problem of animal evolution in its broadest sense. In the first few pages of these two works, it is easy to discern the author's personal standpoint, and to foresee that the third volume will contain an elaboration of the psychology of the 'Descent of man.' Reserving, however, a complete discussion of the final question for the later work, he carries us here to the summit of the lower animal scale, ably following every line of inquiry. Although not a profound thinker, Mr. Romanes is a thorough and original investigator; and his previous labors, both in biology and psychology, qualify him peculiarly for this line of research. While as a philosopher he generally follows Hume, Mill, Bain, and Spencer, his position as a psychologist is often very independent. As a follower of Darwin, he naturally inclines strongly to his views on many questions; attributing to natural selection almost unlimited influence in the development of instinct and intelligence.

Based upon the generally accepted truth of the evolution theory, below the human scale,

the plan of the work is, first, the collection of a vast number of authentic observations upon the lower animals (this, with general comments, occupies the whole of the volume upon 'Animal intelligence'); second, a close analysis of the tests of mind, its physical basis, and the means we have of determining its presence; third, an examination of the mental faculties, such as consciousness, sensation and perception, instinct and reason, in their higher and lower manifestations; fourth, the application of actual observations to the determination of the various levels in the animal scale at which these phenomena of consciousness, sensation, and so on, appear; finally, a full discussion of the problem of instinct, as arising parallel with intelligence. The chief merits, as well as the special and almost insurmountable difficulties of Mr. Romanes' work, are met with in these last two sections. In the accumulation of well-ascertained facts, he has started in a sound scientific method: the interpretation of these facts is a most delicate task.

Is a certain act prompted by instinct, or intelligence? Does it indicate conscious choice, or merely the response of reflex action to a certain stimulus? Does it indicate a knowledge of the relation of means to end? These are subtle problems all along the line from the anthropoid ape to the Amoeba: their interpretation by the two schools of psychologists is often directly contradictory, yet upon this the whole argument must rest. The difficulties increase as we descend the scale. The minds of others can only be known as ideal projections of our own mental states. Here arises the doubt, in applying our criteria of mind to particular cases, which increases as we recede from minds like our own to those less so, passing into a gradual series to not-minds.

The observations in the first volume under consideration relate to members of all the larger divisions of the animal kingdom. Their number and variety are surprising; and, although the author has carefully endeavored to exclude all those in the least degree doubtful, many of them will appear incredible to persons unfamiliar with this class of literature. These anecdotes form a superb field for induction; yet many of them are marred for scientific purposes by the hasty conclusions of the observers, which are appended. In the closing chapter upon monkeys, there is a novel diary of the habits of a brown capuchin, which was written for two months by Miss Romanes.

In the second volume, before seeking to determine the levels at which we meet the lower and higher mental phenomena, the author tries to show very clearly his own conception of mind, and by what means we can legitimately infer its presence in an animal. "The distinctive element of mind," he says, "is consciousness, and the test of consciousness is the power of choice." The function of selective discrimination with the complementary power of adaptive response is regarded as the root-principle of mind; and it is found only in agents which are capable of feeling. These root-principles of feeling and choice may be traced down into the vegetable kingdom, where, for example, we find an insectivorous plant rejecting a bit of glass, but feeling and closing upon a fly. To the objection that plants are not in any proper sense capable of feeling, the author allows that at the bottom of the scale the terms have lost all their original meaning; yet the apparent abuse of terms serves well to emphasize the fact of the gradual dawn of these powers. The great stress of Mr. Romanes' argument, as a consistent evolutionist, is the universal gradation which we find throughout the scale, which he strictly maintains is one of *degree* only, although it may appear to be one of *kind*. With this principle of gradation constantly in mind, the reader will be less surprised at some of the author's conclusions.

We see feeling and choice acquiring the semblance of their higher meaning among the coelenterates, in the Medusae for example, where we first find definite sense-organs. In this group, accordingly, following Spencer, the author discovers 'the raw material of consciousness.' Here arises another difficulty in distinguishing between the mental choice of consciousness, and the apparent, but not real mental choice of reflex action; and the only distinction that can be drawn consists in the latter "depending on inherited mechanisms within the nervous system, being so constructed as to effect *particular* adaptive movements in response to *particular* stimulations, while the former are independent of any such inherited adjustments." Reflex choice is habitual and invariable: mental choice decides between one of two alternatives, in case of new experience. Sensation is feeling aroused by a stimulus, and always attended by consciousness; and, together with the rise of conscious choice, we meet the dawn of intelligence, or mind as we generally understand it. Does the organism learn by its own individual as distinguished from its race experience? If it does so, its mind is placed beyond the area of merely reflex action.

Having advanced thus far, the author first

discovers memory of a low order among the gastropods; experiments with the echinoderms and higher crustaceans having, up to this time, given rather negative results. The latter fact is the more surprising; because among some of the terrestrial arthropods — the ants, bees, and wasps — this faculty is so wonderfully developed. Memory of the higher kind, which depends upon the association of ideas by similarity, is met with among the fish and batrachians. This involves another faculty; namely, perception. Differing from Spencer in many particulars, and showing less confidence in himself as to the rise of perception than at other points, the author in general regards it as the faculty of cognition, and finds clear evidence of it among the insects, reaching the general conclusion that reflex action and perception advance together. Imagination is stated to rise step by step with memory and perception among the mollusks, insects, spiders, crustaceans; and the doubting reader is referred to the actual observations in 'Animal intelligence' which sustain these conclusions. As to the more complex mental powers, proceeding in the same line of argument, the author discovers reason, with a knowledge of the relation between means and end, among the bees and wasps; in this order he also observes communication of ideas; understanding of words, and dreaming, are found among the birds; tools are intelligently used by monkeys and elephants; an indefinite sense of morality is seen among dogs and anthropoid apes. The discussion of conscience, volition, and abstraction, is reserved for the last volume. The various approximate levels at which the signs of the emotions, the will, and the intellect appear, are presented in a large diagram, in which the faculties branching out from a single stem, neurility, are seen in a condensed view of the entire system.

Fully one-half of 'Mental evolution in animals' is devoted to the subject of instinct; and as it is treated with the utmost fulness and clearness, with a critical discussion of the theories of different writers, it forms an invaluable and standard contribution to this much mooted subject. In general, supporting the theory of Darwin in opposition to the contradictory views of Lewes and Spencer,[1] it is shown that the origin of instincts may be either primary or secondary; that is to say, —

"Instincts may arise either by natural selection fixing on purposeless habits which chance to be profitable, so converting these habits into instincts (primary), without intelligence ever being concerned in the process; or by habits originally intelligent becoming by repetition automatic (secondary)."

[1] In his Principles of psychology. This work was written before the publication of the Origin of species. Mr. Spencer now admits the wide influence of natural selection.

While either of these causes may work alone, yet frequently in co-operation they evolve instinct more rapidly by blended origin. Instinct is accordingly defined as "reflex action into which there is imported the element of consciousness;" and the point is ably sustained, that Spencer's derivation of instinctive from reflex actions merely, is inadequate for the higher animals, while Lewes's theory of the 'intelligence' origin is inadequate to explain the instincts of the lower animals. Darwin's essay on instinct, part of which only appeared in the 'Origin of species,' is published as an appendix to this volume. The author acknowledges his indebtedness to this, as well as to many manuscript notes left him by the great naturalist.

An outline has been given of these unusually interesting works; and there is little space left for extended criticism, although at many points it is richly deserved. We find, among other defects, that the candor of the author's preface is not sustained throughout. He disclaims the discussion of all philosophical questions, such as the causal relations between mind and matter, as apart from the objects of the book; yet, at several rough places where he feels called upon to explain the origin of faculties, he does it in terms of nerve fibres and cells. For example: in the origin of consciousness we find him groping after Spencer, and, with some hesitation, deriving this faculty from 'ganglionic friction;' while at another turn he reverses the causal relation, since it is convenient to do so, and suggests a psychical cause for some material change. Discussing the origin of nerve-fibres, he again quotes Spencer; although Balfour, in his address before the British association in 1880, gave the whole weight of his authority against Spencer's theoretical views. The accounts given of the evolution of the first germs of mind and nerves are necessarily obscure and assailable. It is true that pure speculation is unavoidable in such an intangible sphere of inquiry; but the intrinsic merits of the argument are dimmed, and we believe the truth is delayed, when the reader is so often left in doubt as to where the author's observation ceases and his imagination begins. As before stated, it is not the facts of actual observation brought forward, but the character of the inferences which are drawn from these facts, which will arouse controversy.

The American edition of 'Mental evolution'

is a careless publication. Besides numerous typographical errors, those who were unfortunate enough to purchase an early copy found two important diagrams omitted, one of which is absolutely essential to the understanding of the context.

FISKE'S ELECTRICITY.

Electricity in theory and practice; or, the elements of electrical engineering. By B. A. FISKE. New York, *Van Nostrand*, 1883. 270 p. 8°.

THAT the work of Lieut. Fiske meets in some degree a want felt by a considerable number of persons, is sufficiently shown by the fact that it has already reached a third edition; but we must nevertheless confess to a feeling of serious disappointment on reading it. The expectations raised by the title are hardly justified by the contents; since the discussions of theoretical points are very brief and unsatisfactory, while the portion treating of electrical engineering proper is somewhat ill-digested. In fact, there is a certain 'scrappiness' about the work as a whole, which is apparently due to over-haste in preparation.

The first five chapters, occupying about one-fourth of the book, are extremely elementary, and contain little that will not be found more fully stated in almost any work on electricity, while occasional loose statements also occur. Thus, in the chapter devoted to work and potential, the writer seems to overlook the exactness introduced into scientific measurements when Gauss first proposed an absolute system of mass and force measurement. Immediately after the definition of the foot-pound, we find the following statement: "This unit is, however, too large for measuring with convenience in many cases; and for this reason a much smaller one has been invented, called the 'erg.'" The only definition given of the dyne is "an extremely minute weight, being about $\frac{1}{981}$ of a gramme." Other examples are to be seen in the table on p. 214.

Such laxity of expression, although it may seem to simplify the subject, cannot fail to prove confusing as soon as the reader really begins to study the matter. Similar want of care in expression will trouble the student while reading certain parts of the chapter on the laws of currents. From the statements on p. 60, regarding the arrangement of battery-cells, the reader might erroneously infer that high internal resistance in a cell is in itself advantageous in increasing the strength of the current given by a battery.

Considering the portion of the work devoted to the applications of electricity, we find a great inequality in the space devoted to important matters. The subject of electro-metallurgy is allowed but a single page, and the extensive use of dynamo-machines in the electrical deposition of metals is not discussed at all. Of the ten pages given to storage-batteries, five are filled with a mere statement of the claims of certain recent patents, without any information regarding their value. On the other hand, neither the chemistry of the lead-battery nor the special advantages and disadvantages of the storage-battery are considered. The chapter on thermo-electric batteries contains no allusion to any form of thermo-battery whose use in the arts has been attempted; and there is not even a mention of the names of Farmer, Noë, or Clamond. Instead of this, five pages of patent claims are given, several of which are not, in fact, for thermo-electric batteries proper.

The remainder of the work deserves somewhat more praise. The chapter on electrical measurement contains a description of the earlier forms of ampère-meter and volt-meter of Deprez and Ayrton and Perry. There is no reference to Sir William Thomson's current and potential galvanometers. Under telegraphy we find the bridge duplex method described, but the differential method is not alluded to. The principles of the quadruplex, as well as those of the harmonic telegraph, are, however, explained. The chapter on the telephone is interesting. It is unfortunate that not even a passing mention is made of the Blake transmitter; while the rarely used transmitter of Edison, and his ingenious but unpractical electro-motograph receiver, are described at some length. The following chapters on electric lighting, dynamo-machines, etc., are, on the whole, the best in the book. The principle of the differential arc-lamp is explained, and brief descriptions are given of most of the leading types of dynamo-machines. The closing chapter on electric railways contains, among other matters, an account of the system of Field and Edison.

In justice to the work under review, we ought to say that many of the faults which we have criticised have their origin in the fact that our author has attempted the impossible feat of discussing the theory and practice of electrical engineering in a work of only two hundred and sixty-five pages. As a consequence, neither theory nor practice is described at sufficient length to meet the wants of the reader. Moreover, we are firmly of the opinion that any one

wishing to understand the applications of electricity must first acquire a thorough knowledge of the theory. Having secured this, he will find no trouble in reading any works devoted to the practice of electrical engineering.

AMERICAN COASTER'S NAUTICAL ALMANAC.

The American coaster's nautical almanac for the year 1884. Published by authority of the secretary of the navy. Washington, *Bureau of navigation*, 1884. 158 p. 8°.

IT has long been customary for the principal dealers in chronometers, hydrographic charts, and navigation supplies generally throughout the country, to publish annually, in cheap pamphlet form, certain of the fundamental data required in the navigation of ships, and compiled largely from the publications of the 'Nautical almanac' office. Such small prints have commonly been disposed of for a few cents per copy, or given away to masters of vessels, as the tabular data were so scattered among advertisements of the wares of these dealers as to render their distribution a matter of interest to the publishers.

The recent action of the superintendent of the 'Nautical almanac' office, in beginning the regular issue of the 'American coaster's nautical almanac,' will, it is to be hoped, put an end to this unauthorized extraction from the publications of the scientific offices of the government; for the new annual will contain, in a compact and convenient form, the ephemeral data of every sort required by navigators along the American Atlantic coast, and is issued under the official sanction of the secretary of the navy. The 'Coaster's almanac' is made up from data already in good part accessible to navigators in one form or another, but which are now, for the first time, brought together into a single small volume, obtainable with little trouble and expense.

We have first the elements pertaining to the position, motion, and apparent magnitude of the sun, together with the equation of time, — all given for Greenwich noon, as in the larger annuals of the same office. Following are the times of the moon's phases, — where, by the way, the meridian is omitted, and a doubt is likely to arise whether they may not be applicable to some meridian other than Greenwich, — underneath which we find the sidereal time of mean noon, and blank columns left for the navigator to enter with every day the necessary data regarding his chronometer, and the latitude and longitude of his vessel at noon. The next succeeding pages contain the positions of a hundred and fifty fixed stars for the beginning of the year, followed by a table for finding the latitude by an observed altitude of Polaris, and a table for converting solar into sidereal time. A matter of some account is the omission from this portion of the 'Coaster's almanac' of all data regarding the planets. A half-dozen additional pages would have sufficed to give the positions of the four bright planets ordinarily employed by navigators, with precision enough to make them quite as useful as the list of star-positions.

The astronomico-nautical data occupy nearly forty pages, or about one-fourth of the entire book. Following are twenty pages of tidal data, compiled from the complete tide-tables published by the office of the coast and geodetic survey. The approximate predicted times of high water at the principal ports on the Atlantic coast of the United States are given for every day of the year; while, for intermediate ports, tables of tidal constants are added. The times of high water are reduced to the standards of the eastern and central meridians, respectively five hours and six hours slow of Greenwich time.

We have next a very comprehensive list of more than five hundred lighthouses, lighted beacons, and floating lights, on the Atlantic and Gulf coasts of the United States, occupying thirty-five double pages, and giving the name, location, characteristic, and order of each light; also the geographical position, height above the sea-level, maximum distance at which visible, the color and peculiarity of the lighthouse or vessel, and the character of the accompanying fog-signal. This is followed by a ten-page list of lights in the West-India Islands, and on the adjacent coasts, the coast of Brazil, etc., to the Magellan Straits, similar data being likewise given for these lights. The 'Coaster's almanac' concludes with nautical directions for manoeuvring in, and avoiding the centre of, cyclones in the North Atlantic; the twenty-six articles of the revised international regulations for preventing collisions at sea; general information regarding life-saving stations, with instructions to facilitate the shipwrecked mariner in receiving the assistance of these stations; and, finally, descriptions and explanations of the signals displayed by the army signal-service as cautionary against approaching storm, severe winds, and rough weather generally.

The new almanac bears in every part the marks of preparation with a considerate regard for the wants of that class of men likely to use it; and the make-up of its contents has evidently been in large part suggested by, or under the direction of, some officer fully acquainted with the routine and necessities of practical navigation; and subsequent issues may be expected to contain many additional improvements. The 'Coaster's almanac' is not intended to replace the 'American nautical almanac,' or navigator's edition of the large 'Ephemeris,' which has been issued by this office for each year since 1855, and will be continued as heretofore.

METALLURGY OF PRIMITIVE NATIONS.

Die metalle bei den naturvölkern, mit berücksichtigung prähistorischer verhältnisse. Von R. ANDREE. Leipzig, *Veit & Co.*, 1884. 10+166 p., 57 illustr. 8°.

IN our epoch the primitive status of savage nations rapidly disappears, and the manufacture of the last tools recalling the stone age will soon be abandoned. The factories of New England already furnish cast-steel tomahawks to our western Indians, and the Central-African negro shoots the hippopotamus and elephant with a breech-loader of the most recent pattern. Facts like these are a sufficient warning to the ethnologist for collecting *now* whatever can be brought to posterity from the implements and rude machinery of the lower races of mankind. To aid this purpose, Andree has undertaken to illustrate one branch of ethnologic research, metallurgy, and to show the extent of our present knowledge concerning its practice among the above races.

His learned treatise excludes the European and Semitic nations, of which the metallurgy is sufficiently known, and had, except within the most recent times, but little direct influence upon that of primitive nations. The most important metals to be considered were iron, copper, tin, and bronze. The Egyptians of the earliest period were acquainted with bronze and iron; but the manufacture of iron tools by the Central-Africans was an invention of their own, and not borrowed from Egypt. It first developed in north-eastern or in Central Africa, and from there must have reached southern Africa, as Andree believes. Iron tools followed immediately upon stone tools, since copper is limited to a few portions of that continent only. The East Indies had a stone period for themselves; and metals, except tin, do not seem to have been imported there. Copper is obtained by very archaic methods. It cannot be decided which metal, copper or iron, is of older use in that country.

The Malayan nations form another independent area or domain of metallurgy, their peculiar practical methods reaching from Madagascar to New Guinea. Iron was their oldest metal, and it probably was so among the Indo-Chinese as well. In its cultural development, China stands wholly for itself, and thirty-five hundred years ago it produced the finest bronzes; but Chinese prehistorics have not as yet been sufficiently studied to decide which metal was the first to be wrought in that distant realm. When Russia invaded Siberia, some of its tribes were reducing and working iron ores, having been probably taught by Turkish nomads. Meteoric iron was put to use by several American tribes, especially by the Eskimo. The reduction of ores by charcoal, and their smelting by fire, were discovered at three different spots in this western hemisphere, wholly independent of each other, — in Mexico, in Cundinamarca, and in Peru. The chief metal of Mexico was copper; of Peru, bronze; though both were used simultaneously with stone implements. Analyses made of American bronzes have proved them to be alloys of metals joined in very different proportions.

The 'Scandinavian' theory, that in every part of the world the metals should appear in the same historic order — copper, tin, bronze, iron — among all, even the most heterogeneous nations, has held supreme sway in science for almost half a century, but is now entirely upset by the investigations of R. Andree and others. A fact which alone would suffice to disprove it is this, that the production of bronze is a more difficult process than the production of iron. Many nations have borrowed metallurgic processes and methods from other nations, as proved in many instances; but these methods and practices have also been the result of inventions independent of each other; and, to explain the similarity of processes in countries widely separated from each other, the assumption of separate invention is the most probable and natural of all.

Although the above results gleaned from Andree's publication give only a superficial idea of its contents, we deem them sufficient for attracting the notice of ethnologists and archeologists, and add the statement that every page of it teems with important or unexpected disclosures.

INTELLIGENCE FROM AMERICAN SCIENTIFIC STATIONS.

GOVERNMENT ORGANIZATIONS.

U. S. geological survey.

Yellowstone national-park survey. — Preparations for field-work by the Yellowstone park division, under Mr. Arnold Hague, are now nearly complete. The experience of last season enables the members of the party to take the field with a fair idea of the nature of the volcanic rocks of the park, and of the thermal problems with which they will have to deal. Last summer's notes have been condensed and arranged for the purpose of comparing the conditions of the springs and geysers observed with their conditions during the corresponding months of this year. A comparison of the thermal activity observed in 1883 with the intensity displayed in 1878 shows, that in the greater number of instances the changes have been unimportant, and that, contrary to the opinion frequently stated, there has been no diminution in the intensity of thermal action in the park during the last six years.

Mr. Hague reports that two additions should be made to the list of active geysers, — one in the Fire-hole basins, in the lower geyser basin, and one in the upper basin. The former is situated on the broad sinter terrace or flat, that lies north-west of the mounds of the 'Fountain Geyser.' Dr. Peale, in his report of 1878, suggests the possibility of its being a geyser. It has a large, gray pool (ninety to a hundred feet in diameter), without any particular beauty of form or color. Near the west border of the pool is a fissure-like vent, over which the water, owing to its greater depth there, has a dull-green color. The following description of an eruption is from the note-book of Mr. Walter H. Weed: —

"At 5 P.M. (Sept. 25, 1883) the water was perfectly quiet, no ebullition whatever being noticed. At 5.02 a large volume of steam was thrown out, accompanied by a vigorous bulging of the water, which increased in violence until at 5.05 a mass of water, six to eight feet in diameter at the base, was thrown up in a tapering column from twenty-five to thirty feet high. For twenty seconds these spurts continued, after which the column fell, and the water boiled quietly for ten seconds. Bulging again commenced, and continued, with occasional subsidence, until 5.13, the jets varying in height from three to twenty feet. The total duration of the eruption was eleven minutes. From 5.13 to 5.43 the water boiled quietly; at the end of this time bulging again commenced, and another eruption similar to the first occurred. There are apparently two vents; the jets acting together, yet not perfectly synchronous. A low, heavy mass is shot up from the lesser vent."

This geyser has been named the 'Surprise.' From the height of the column and force displayed, it will rank as the third geyser in the Lower Basin.

The new geyser of the Upper Basin is in the Emerald group, and is the spring No. 9 of that group, described in Dr. Peale's report. Mr. Hague has named it the 'Cliff Geyser,' as it lies so close under the wall which skirts the west bank of Iron Creek. Mr. Weed was fortunate to witness this geyser in action, and describes an eruption, under date of Aug. 27, 1883, as follows: "This geyser presents a shallow basin, with rather ill-defined margin, formed of thin plates of honeycombed geyserite. The water near the edge is turbid, and from two to eight feet deep, and, when first observed in action, was boiling vigorously at a number of points. A few minutes later the water bulged violently to a height of six feet in the centre of the basin, sending out waves in all directions, which broke upon and ran over the low margin. This was soon followed by another bulge eight feet high, succeeded by a series of spurts and bulges lifting the central mass of water to a height of thirty to fifty feet. This continued for two minutes and a half, when the violence of the eruption became less and less, until the jet was but three to eight feet high, continuing for two minutes, when the water receded, still boiling vigorously. The inner basin was now seen to be approximately thirty feet in diameter, with a somewhat muddy bottom, blotched with black and orange, surrounded by a shallow, gray-white and black-lined outer basin, fifty by sixty feet. Half an hour later a second eruption occurred, quite similar to the first. These eruptions resemble those of the Giantess in appearance."

U. S. bureau of ethnology.

Annual reports. — The third annual report is all in type, and will soon be issued. The second report is now being issued: it is a volume of five hundred and fourteen pages (i.–xxxvii., 1–477), illustrated with seventy-seven plates, seven hundred and fourteen figures, and two maps. Thirteen of the plates are chromolithographs. The report of the director details the office and field work of the bureau for the fiscal year 1880–81, and presents some remarks introductory to the accompanying papers, which immediately follow. These are seven in number: viz., 'Zuñi fetiches,' by Frank Hamilton Cushing; 'Myths of the Iroquois,' by Erminnie A. Smith; 'Animal carvings from the mounds of the Mississippi valley,' by Henry W. Henshaw; 'Navajo silversmiths,' by Dr. Washington Matthews, U.S.A.; 'Art in shell of the ancient Americans,' by William H. Holmes; 'Illustrated catalogue of the collections obtained from the Indians of New Mexico and Arizona in 1879,' by James Stevenson; and 'Illustrated catalogue of the collections obtained from the Indians of New Mexico in 1880,' by James Stevenson.

Mr. Cushing's paper occupies thirty-seven pages. The fetiches most valued by the Zuñis are natural concretions or eroded rock forms, having an obvious or fancied resemblance to certain animals, or objects of that nature, in which the evident original resemblance has been heightened by artificial means. Eleven plates and three figures show a number of these fetiches, three of the plates being colored.

It is the plan of the bureau to preserve and record

the myths and folk-lore of the several tribes in their own languages, with interlinear translations. The paper of Mrs. Erminnie A. Smith, although it does not in this volume present the original language, is written after the reduction of the original to writing in the course of her linguistic work, after a prolonged residence among the Iroquois tribes, into one of which, the Tuscarora, she was adopted. It is therefore an authoritative rendering of some of the Iroquois myths, some of which have appeared in other forms, and others of which have been for the first time collected by herself. Mr. Henshaw, in forty-four pages, discusses the animal carvings from the mounds of the Mississippi valley, and reaches the following general conclusions: —

1°. That, of the carvings from the mounds which can be identified, there are no representations of birds or animals not indigenous to the Mississippi valley, and consequently that the theories of origin for the mound-builders suggested by the presence in the mounds of carvings of supposed foreign animals are without basis;

2°. That a large majority of the carvings, instead of being, as assumed, exact likenesses from nature, possess in reality only the most general resemblance to the birds and animals of the region which they were doubtless intended to represent;

3°. That there is no reason for believing that the masks and sculptures of human faces are more correct likenesses than are the animal carvings;

4°. That the state of art-culture reached by the mound-builders, as illustrated by their carvings, has been greatly overestimated.

Dr. Matthews' paper is of eight pages, and is illustrated with five plates. Mr. Holmes's paper, one of the most important in the volume, is noticed on another page. Mr. Stevenson's papers are also fully illustrated, a number of the plates being colored; and his catalogues are not merely enumerations, but are accompanied by a judicious amount of discussion and comparison, which render them of substantial value. The volume has not only a complete table of contents and a full index, but each paper has a separate table of contents, and list of illustrations.

RECENT PROCEEDINGS OF SCIENTIFIC SOCIETIES.

Academy of natural sciences, Philadelphia.

June 10. — The Rev. Dr. H. C. McCook stated that in November, 1883, he received from Mr. Webster of Illinois two globular nodules of earth, each about the size of a grape, which were thought to be the cocoons of a spider. Similar balls had often been found attached by a slender thread or cord of silk to the under side of fallen boards. Dr. McCook was much puzzled to decide upon the nature of these objects, but, on the whole, believed them to be the work of some hymenopterous insect, and not of a spider. Two ichneumons which emerged from similar cells were determined by Mr. E. T. Cresson to be Pezomachus meabilis Cress. Subsequently Mr. Webster sent other specimens, some of which were opened. They contained silken sacs embedded in the centre of the mud-ball, apparently of spider spinning-work; and within these were fifteen or twenty yellowish eggs, evidently those of a spider. The disjecta membra of two adult spiders taken near the balls, although much broken, enabled him to determine them as drassids (a family of the tube-weavers), and probably of the genus Micaria. These had been found simply near the mud-balls, but the connection between them had not been established. Dr. McCook moistened the cocoons in order to give a natural condition more favorable for the escape of the spiderlings, should they hatch; and on May 30, on opening the box, he found about thirty lively young spiders therein. On the bottom of the box was a dead ichneumon, which had cut its way out of the side of one of the balls by a round hole. The spiderlings seemed to have escaped from their ball along the slight duct left at the point where the bit of silken cord was embedded in hard earth, and thence protruded, forming the cocoon-stalk by which the ball was attached to an under surface. The appearance of the spiderlings indicated that they had been hatched two or three days when first seen. They were evidently drassids of the same species as the broken specimens above alluded to. Thus the interesting habit of concealing her future progeny within a globular cradle of mud was demonstrated to belong to a spider as well as to a wasp. That this particular species is much subject to the attacks of hymenopterous parasites is already proved; but that it is more exposed than many other species which spin silken cocoons, otherwise unprotected in very many localities, does not appear. There is no evidence that so strange a habit has developed from necessity, and none that it proves more protective than the ordinary araneal cocoonery. Dr. McCook had named the species, provisionally, Micaria limnicunae (*limnus*, mud, and *cunae*, a cradle), although it is possible that Hentz may have described the species as one of his genus Herpyllus. The only spider-cocoons known to the speaker, at all resembling those of M. limnicunae, he had collected at Alexandria Bay, N.Y., on the St. Lawrence River, in 1882. They were attached by very close spinning-work to the under side of stones. But the external case, instead of being of mud, was a mass of agglomerated particles of old wood, bark, leaves, blossoms, the shells and wings of insects, etc. These were held together by delicate and sparsely spun filaments of silk. Two of these chip-balls were opened, and found to contain whitish cocoons similar to those in the mud-balls of M. limnicunae. Another had within it the characteristic cell of some hymenopterous parasite containing a dried-up pupa. A very thin

veneering of yellow soil enclosed the silken case, but otherwise no mud was used. On comparing these specimens with those from Illinois, it was believed that they were the work of closely related or perhaps the same species. It is very common for spiders of various and widely separated families to give their cocoons a protective upholstering of scraped bark, old wood, etc., and not unusual to find species that cover their egg-nests wholly or in part with mud; but the speaker was not aware that any species had yet been published as making cocoons like either of the above described forms. He believed, therefore, that the facts were wholly new to science: certainly they were new to the field of American araneology.

June 17. — Referring to the Lycosa, whose weaving of a round cocoon had been the subject of study in the early part of May (see *Science*, iii. 685), Rev. H. C. McCook stated that on June 4 the spider was found with the young hatched, and covering the upper surface of her body. The empty egg-sac still clung to the spinnerets, and the young were grouped over the upper part of the same. The entire brood was tightly packed upon and around each other, the lower layers apparently holding on to the mother's body, and the upper to those beneath. Twenty-four hours afterward the cocoon-case was dropped, and the spiderlings clung to the mother alone. An examination of the cocoon showed that the young had escaped through the thin seam or joint formed by the union of the egg-cover with the circular cushion when the latter was pulled up at the circumference into globular shape. There was no flossy wadding within, as is common with orb-weaving spiders — nothing but the pinkish shells of the escaped young. One week later about one hundred of the spiderlings had abandoned the maternal perch, and were dispersed over the inner surface of the jar, and upon a series of lines stretched from side to side. About half as many more remained upon the mother's back, but by the 13th all had dismounted. Meantime they had increased in size at least one-half, apparently without food. —— Professor Angelo Heilprin exhibited a number of microscopic slides, received from Mr. K. M. Cunningham of Mobile, containing foraminiferous dredging from the Red Snapper Bank, off Mobile harbor, Gulf of Mexico, and preparations of organisms from the rotten limestone of the north-eastern portion of Mississippi, — a rock which represents the inner border of the Gulf during the cretaceous period. The recent forms of foraminifera are interesting as affording material for comparison with those of the ancient sea. There is a remarkable difference in the forms. From the present waters, about eight genera are indicated by the slides in question; Discorbina, Rotalia, Textularia, Cristellaria, and Nodosaria being included among the Perforata. Although Globigerina forms such an important feature of the ooze of the open seas, not a single specimen which could with certainty be referred to this genus was found in the material from the Gulf of Mexico. Textularia was the most abundant form. Among the Imperforata, we have, of the family Miliolidae, a very considerable abundance of Quinqueloculina and Biloculina. In the foraminifera of the limestone the family represented by these genera seems to be entirely absent, and but few of the others are left. Discorbina and Textularia almost make up the entire fauna represented by the specimens received. Even these are of much smaller size than corresponding forms from the Gulf ooze. It is not a little surprising that there should be such a distinction between the organisms of the two periods, in view of the continuous existence of the body of water in which they lived, and of the persistent types which they represent. About twenty-five distinct forms of foraminifera had been determined from the greensand of New Jersey, which is the approximate geological equivalent of the rotten limestone of Mississippi. —— Professor Heilprin also exhibited a specimen of a beautiful little trilobite, Calymene Niagarensis, from the bank of the Yazoo River, above Vicksburg. The formation at the locality indicated is eocene; but, as Silurian beds exist farther up the stream, the presence of the specimens at the point from which they were collected undoubtedly represents a downwash from above.

Botanical section, June 5. — Mr. Thomas Meehan remarked that few botanists would expect to find opposite leaves in Salix; but in S. nigra Marshall they appear at a certain stage of growth, — a fact which has much significance. This species is of that section which has the flowers co-aetaneous with the leaves; that is to say, instead of the aments being sessile, they terminate short branches. They are, however, not absolutely terminal, but appear so by the suppression for a time of the terminal bud. In the case of the female ament, this terminal bud usually starts to grow very soon after the flowers mature, and forms a second growth, when the fertile catkin or raceme of fruit becomes lateral. It is the first pair of leaves on this second growth that is opposite: all the rest are alternate, as in the normal character of the genus. The leaves are so uniformly opposite, under these circumstances, that there must be some general law determining the condition, which has not yet been developed.

Engineers' club, Philadelphia.

June 7. — Mr. William H. Ridgway described a simple crane, consisting of a cylinder hung from the jibs of an ordinary foundry crane, and using the steam directly to hoist the load. —— Mr. C. Henry Roney exhibited specimens of American sectional electric underground conduits as laid in Philadelphia. —— Prof. L. M. Haupt supplemented his paper of May 17, upon rapid transit, by an interesting collection of statistics of the growth of the city from the time of the 'pack-horse' to the present, and showed by maps that his previous statements were verified by these statistics. —— Mr. A. E. Lehman exhibited to the club a model of a new protractor, and described the invention and the improvements he has made in it. It consists of a combination of protractor, T-square, scales, etc., which may be worked separately or together. As a protractor only, it is complete, being

graduated to degrees and fractions thereof, and provided with a vernier reading to three minutes. It can be used, like an ordinary paper or ivory protractor, for hasty plotting, and combines triangles and scales in one instrument. For careful and precise work, it is said to be equal to the best special instrument, and to be no higher in price. —— Mr. E. V. d'Invilliers read a paper on some characteristics and the mode of occurrence of the brown hematite (limonite) ores in central Pennsylvania, taking for his field of illustration the lower Silurian limestone valleys of Centre county. He described the anticlinal structure of these valleys, and the great erosion, aerial and subaerial, which these rocks (six thousand feet thick) have undergone, influencing the position and character of many of the present ore-deposits. He noted three varieties of ore: 1°. The wash and lump hematite of the Barrens; 2°. The true limestone 'pipe ore.'; 3°. An intermediate *transition* variety. The first is always associated with the sandy magnesian beds low down in the series of No. 2, or below five thousand feet beneath the overlying Hudson-River slates of No. 3. This class shows rounded ore and flint balls, and tough, barren clay, and are secondary or derived deposits of irregular shape. They have been tested a hundred feet deep, and contain from 45% to 53% iron, and .051% to .113% phosphorus. The almost total absence of bisulphide of iron is noticeable. The cost of mining is about a dollar and a half per ton. The transition variety was assigned a position in the formation from thirty-five hundred to five thousand feet below the slates. They are characterized by a more calcareous clay, are compact, amorphous, liver-colored ores, containing from 40% to 49% iron, and from .115% to .365% phosphorus. The pipe ores occur usually higher in the limestones than either of the other two, but in this county *below* the four hundred feet of upper Trenton layers. These ores occur *in situ* between parallel walls of limestone, in plate-like masses, scales, or as cylindrical pipes in bunches eight or ten feet long, while feathering out both in line of strike and dip. The deeper banks show the repeated occurrence of crystals of iron pyrites in all stages of metamorphism. They occur at great depths, and show from 45% to 53% iron, and from .100% to .185% phosphorus. The flint or quartz grains accompanying them are rarely water-worn; and this clay is very calcareous and easily washed, not requiring the jigging necessary for cleansing the lower ores. Cost of mining these ores varies from ninety cents to a dollar and a quarter per ton.

New-York microscopical club.

June 6. — Rev. J. L. Zabriskie read a notice of Appendicularia entomophila Peck, a new fungus parasitic on the fly Drosophila nigricornis Loew. The fly, determined by Dr. H. A. Hagen of Cambridge, was noticed at Nyack, N.Y., between the 13th and 31st of March last, infested with the fungus. But infested specimens have not since been found. In the spring of 1880, three specimens of the same fly, similarly infested, were captured at New Baltimore, N.Y. These latter specimens were preserved and mounted; but, from lack of time and opportunity, the true nature of the parasite was not then recognized. The fungus has been submitted to Prof. C. H. Peck, New-York state botanist, who has kindly examined it, and named it Appendicularia entomophila. It is closely related to the Sphaeronemei of the family Coniomycetes. Like Sphaeronema, the fruit has a bulbous conceptacle, surmounted by a long beak perforated at the apex, where the spores ooze out in a globule; but, unlike any described Sphaeronema, this has the conceptacle seated upon the broad summit of a pedicle as long as the conceptacle itself; and also on one side of the summit of the pedicle and at the base of the conceptacle, it has an erect, leaf-like appendage, with strongly serrate margins, like a white-elm leaf folded along its midrib. The spores are slender, pointed at each end, and divided by a septum into two unequal cells, one cell being twice as long as the other. The total length of the fruit is from .02 to .03 of an inch, and that of the spores from .001 to .002 of an inch. The conceptacles of the fungus project directly from different points of the surface of the fly; so that they are found in all positions, — erect, horizontal, and dependent. They grow sometimes singly, but oftener in clusters of two, three, or more, and are found most frequently on the tibiae of the hind-legs, but also springing from the inner posterior surfaces of the abdominal rings, from the costal vein of the wing, from the head, and from the thorax. One of the New-Baltimore flies had about fifty of these conceptacles on various parts of the body and limbs.

NOTES AND NEWS.

DR. GILL has recently paid a visit to the workshop of the Messrs. Repsold, and gives an account of the great Russian telescope, with several particulars not contained in Professor Newcomb's report (*Science*, No. 60). The tube, instead of being cigar-shaped, as in the Washington and Vienna telescopes, is cylindrical, and therefore no larger at the centre than at each end. The object of choosing this form is in order that the centre of gravity of the tube may be as near as possible to the polar axis of the instrument. The central part is of cast-iron. The steel plates diminish in thickness from the centre towards the object-glass, so that the whole structure is extremely rigid. In order to get a sufficient field of view, the micrometer has been made about a foot long. The micrometer contains a small spectroscope, so arranged that the spectrum of any celestial object can be observed without any change of the instrument. It is expected that the telescope will be mounted at Pulkowa during the coming autumn. Some delay, however, has been experienced in getting the dome into working order, and this may still farther delay the mounting of the instrument.

— A memorial tablet, in honor of the late Professor Charles F. Hartt of the geological survey of Brazil, has been placed in the library of Acadia college, Wolfville, N.S. It was here that Professor Hartt

received his collegiate training, and first manifested that interest in the study of nature which became so fully developed, and yielded such good fruit, in after years. The sisters of Professor Hartt were present on the occasion of the unveiling of the tablet, and have presented to the college a fine crayon portrait of their brother, by Black & Co. of Boston.

— It has long been the custom of certain entomologists to form albums of butterflies' wings by pressing the wings on gummed paper. The scales adhere to the paper; but, after they are stripped off, the scales lie with the under side exposed. Milani and Garbini, in the current volume of the *Zoologischer anzeiger* (p. 276), describe the following method of transferring the scales to a second piece of paper, so that they may lie right side up. After the first paper is dry, the second piece is painted with a solution of gutta-percha; the two pieces are then pressed together, and allowed to dry; they are next soaked in water until the gummed paper can be pulled off, and left or washed until all the mucilage is dissolved; the paper with the scales is then dried in the sun. The gutta-percha solution is prepared by soaking five parts gutta-percha, cut very thin, in fifty parts sulphuric ether for twenty-four hours, then adding two hundred parts benzine in which five parts of elemi have been previously dissolved.

— Holmes's 'Art in shell' is an extract from the second annual report of the Bureau of ethnology, shortly to appear. It contains a hundred and twenty-six pages, and fifty-six plates. A small portion of the matter has appeared previously in the second volume of the Washington anthropological society's transactions. Even the present paper is not final, but is to be regarded simply as an outline of the subject, to be followed by a more exhaustive monograph of the 'art in shell' of all the ancient American peoples. The first few pages treat of shells used as implements and utensils, either unchanged by art, or converted into vessels, spoons, knives, scrapers, agricultural implements, fishing appliances, weapons, and tweezers. Much of this matter is familiar; but it is admirably grouped together and illustrated, and new facts are brought to light. Shells were for ornamental purposes converted into pins, beads, pendants, perforated plates, and engraved gorgets. Mr. Holmes studies the beads as to their form in perforated shells, discoidal beads, massive beads, tubular beads, and *runtees;* and as to their uses for ornament, for currency, and for mnemonic purposes. The chapter on wampum will give great pleasure to many readers, but that portion of the paper which treats of engraved gorgets possesses the most absorbing interest. "Many of the gorgets obtained from the mounds and graves of a large district have designs of the most interesting nature engraved upon them." For the purposes of description and illustration, they are presented in the following order: the cross, the scalloped disk, the bird, the spider, the serpent, the human face, the human figure. In addition to the many theories of the origin of the cross symbol, Mr. Holmes suggests the following: "The ancient Mexican pictographic manuscripts abound in representations of trees, conventionalized in such a manner as to represent crosses. By a comparison of these curious trees with the remarkable cross in the Palenque tablet, I have been led to the belief that they must have a common significance and origin." Those familiar with the paper of Dr. Joseph Jones on the antiquities of Tennessee will remember a rosette-like, carved shell, in rough outline resembling a Mexican calendar. Mr. Holmes describes and figures a number of these, believing them to be calendar disks. The bird disks are not very interesting, either in form or variety, although the occurrence of odd forms in widely separated areas will occasion some astonishment. On the contrary, the spider gorgets are both novel and beautiful. If we are not mistaken, it was Col. Hilder of St. Louis who first drew attention to these wonderful objects. Major Powell tells us that the Shoshones regard the spiders as the first weavers, who taught their fathers the art. The wild tribes call the Navajos, spiders. And down in the bottom of a mound, on the breast of a skeleton, lay the disks of the Busycon, on whose concave surfaces were carved the image of this ancestral spinner, bearing the cross symbol on his back. The serpent symbol is a familiar object in aboriginal art, and we are not surprised to find it on shell disks. The remarkable similarity of some of these serpent forms, on disks found in mounds, to the representations of the same animal in Mexican and Central-American antiquities, is barely hinted at by the writer, and dismissed for want of space. The mask gorgets are very rude and uninteresting, but the most astonishing of all are those depicting the human figure. In looking at the drawings, one does not know which to admire more, — the cleverness of the artist in masking his design, or the shrewdness of Mr. Holmes in the interpretation of it. You are asked to look at the image of a man in plate lxxi. You surrender the task as hopeless. The author guides your eye here and there, and you are convinced and delighted. The close examination of the subsequent figures assures you that he is right. We cannot close this brief notice without calling attention to the wonderful unfolding of new problems by the solution of older ones. In the same volume that will contain this paper, by Mr. Holmes, the mound-builders will be severed from Mexico and Central America; but here are new facts to explain, even more perplexing than the old.

— A laboratory for bacterial research has been founded in the Pathological institute of Munich, and the first course of lectures, founded on Dr. Koch's latest methods, has begun.

— Dr. Emmerich, an assistant in the Hygienic institute of Munich, professes to have discovered the cause of an epidemic of inflammation of the lungs, by which a hundred and sixty-one persons were attacked, through discovering the peculiar bacteria of the disease in the plaster of the infected house.

— Mr. Huxley's report of last year's salmon-fishing confirms his own assertion that very little is known about the influences which regulate salmon-supply. The take of salmon and sea-trout has increased and

diminished in defiance of all theories; and Mr. Huxley is equally unable to establish any consistent relation between the take of salmon, and the proportion of grilse present in succeeding years; a large take being sometimes followed by scarcity, and sometimes by abundance of grilse. Mr. Huxley's sympathy with manufacturers has grown with his experience; and, while he acknowledges the importance of the rivers, his confidence in the power of legislation has diminished with experience, but he still insists on the necessity of it. The two points brought out by the continued experiments of Mr. George Murray of the British museum, are, that the fungus may attack fish with whole skins, and otherwise perfectly healthy, and that an excess of lime in the water is not a predisposing cause of the disease.

— The *Popular science monthly* states that Professor John Trowbridge of Harvard university has written a text-book for schools, which D. Appleton & Co. have in preparation. It is entitled 'The new physics,' and admirably carries out the principles of the new education, in requiring the pupil to become familiar with the properties of matter and the phenomena of force by performing experiments for himself.

— A new series of science text-books, each of which is the work of an able specialist, is being brought out by D. Appleton & Co. The 'Physiology,' by Roger S. Tracy, M.D., sanitary inspector of the New-York city health department, and the 'Chemistry,' by Prof. F. W. Clark, chemist of the U. S. geological survey, are now ready. Before Sept. 1, will be issued the 'Zoölogy,' by C. F. Holder, and J. B. Holder, M.D., curator of zoölogy of the American museum of natural history of New York; and the 'Geology,' a new elementary book, by Professor Joseph LeConte of the University of California. Other volumes are to follow soon.

— In his 'Historical account of the Taconic question in geology,' which Dr. T. Sterry Hunt contributes to the recent Transactions of the Royal society of Canada, we find the most complete and systematic of Dr. Hunt's many contributions to this much controverted section of geological history; and even those who do not accept his conclusions must feel grateful for this clear and concise statement of the grounds upon which they rest. The introductory chapter is devoted to an explanation of the classification of the older rocks of eastern North America, proposed by Eaton in 1832, the abandonment of which is regarded as having materially retarded the progress of American geology. The second chapter is a brief history of the geological survey of eastern New York by Emmons and Mather, and an explanation of their divergent opinions concerning the age of the rocks east of the Hudson River and Lake Champlain. Dr. Hunt accepts the name of Ordovician, proposed by Lapworth in 1879, for the rocks called Cambro-Silurian of late years, and including the Chazy, Trenton, Utica, and Hudson-River groups of this country. The older rocks of eastern Pennsylvania are discussed in the third chapter; and the argument for the Taconian or pre-paleozoic age, of the major part at least of the primal, auroral, and matinal of Rogers in the great Appalachian valley, seems to be greatly strengthened by the comparison of the stratigraphy of this valley with that of the Kishacoquillas, Nippenose, and other anticlinal valleys of central Pennsylvania. Typical Potsdam and calciferous are said to be wanting in this state. The gneisses and schists south-east of the great valley are referred to the Laurentian and Montalban systems; and the rocks of South Mountain, to the Arvonian and Huronian. In the fourth chapter, Dr. Hunt traces the distribution of the Taconian system beyond the original areas in Massachusetts, New York, and Pennsylvania, and cites many new facts sustaining his view of its distinctness from the paleozoic above, and the eozoic below. The occurrence of Scolithus and other fossils in the Taconian is asserted; and of especial interest, in this connection, is the discovery by Powell and Walcott in the Grand Cañon of the Colorado, below the base of the Cambrian, of over ten thousand feet of uncrystalline rocks holding Stromatopora-like forms. The next two chapters are devoted to the upper Taconic of Emmons, the Quebec group of Logan, including the Potsdam and calciferous; and the memoir concludes with a general sketch of the paleozoic history of North America.

— Mr. E. J. Maumené has published the result of his investigations into the existence of manganese in wine. In *Cosmos les mondes* for May 17 he gives thirty-one instances in which he detects manganese in the state of a double tartrate of the protoxide of manganese and potash.

— 'The records of the geological survey of India,' part ii., for 1884, contains a note on the earthquake of the 31st of December, 1881, by Mr. R. D. Oldham. This earthquake was felt over a large portion of the Indian peninsula and Bengal, occasioning considerable damage in the Andaman and Nicobar Islands. Mr. Oldham has been enabled to trace the earth-wave with much certainty over a large area, to add considerably to our knowledge of seismic phenomena, and to construct a good map showing the area of disturbance.

— The renewal of the Damoiseau prize by the French academy, for the revision of the theory of the satellites of Jupiter, is announced for the year 1885.

— Dr. Hyades, a member of the French meteorological mission to Cape Horn, attached to it for the purpose of observations on natural history, has published a contribution to Fuegian ethnography, which is interesting as supplementary to the observations of Mr. Bridges, the missionary of the South-American missionary society. Dr. Hyades refers in terms of high appreciation to Mr. Bridges' study of the Galgan language, of which he has compiled a manuscript dictionary, which he has had completely to recast twenty times before bringing it to perfection, and which certainly ought to be published. Some specimens of the vocabulary and of the grammatical struc-

ture of the language are given. The missionaries have succeeded in improving the material condition of the Fuegians, and have induced some of them to adopt agricultural, pastoral, and other industrial pursuits.

— In the current volume of the Proceedings of the American academy, Mr. Arthur Searle publishes an elaborate and exhaustive reduction of all the accessible observations of the zodiacal light. The paper gives the position of the axis of the cone, and the apparent boundaries of the light, as determined by nearly six hundred and fifty different observations by Jones, Heis, Lewis, and others; and tables appended give monthly means and other data which summarize the results in a very complete manner.

Mr. Searle does not indulge in much theoretical discussion as to the nature of the zodiacal light, but he points out that the apparent slight deviation of the axis of the cone from the ecliptic is most probably due to the effect of atmospheric absorption, and calls attention to the necessity of more refined methods of observation. He says, —

"If atmospheric absorption has the importance here assigned to it in the study of the zodiacal light, we cannot expect to determine the true position of the light on any occasion by the simple methods heretofore in use. We must either discover exactly what an observer means by the boundary, and to what extent this boundary will be displaced by given changes of brightness, or we must resort to direct photometric observations. The last course will probably be preferable."

He suggests a modification of the method employed by Wolf in tracing out the nebulosity about the Pleiades, — a method which consisted essentially in watching the visibility of the threads of a reticle, which disappeared whenever the telescope was directed against unilluminated sky.

In this connection he mentions the interesting fact that the Milky Way appears to be about two magnitudes brighter than the mean brightness of the sky; which would mean, of course, that a square degree of the Milky Way gives between five and six times as much light as an average square degree of the rest of the sky.

His only remark as to the theoretical explanation of the zodiacal light is the following: —

"I have merely to remark, with regard to the ordinary meteoric theory, that it gains greatly in simplicity if we dispense with all the imaginary meteoric bodies, or rings, with which it has usually been connected, and retain merely the conception of meteoric dust diffused throughout the solar system. It may be shown mathematically, if we regard the meteoric particles as solids reflecting light irregularly, that an appearance like the zodiacal cone, with an indefinite vertex, would result. On this subject the work of Geelmuyden may be consulted."

We suppose that by 'diffused throughout the solar system,' he means diffused mainly in the plane of the ecliptic. Indeed, it could be shown, that, if we started with an indiscriminate spherical distribution of meteoric dust around the sun, the disturbing action of the planets would ultimately convert it into an approximately discoidal distribution in a plane coincident with the mean plane of their orbits. At any rate, it is not easy to see how an indiscriminate distribution should lead to any thing but a glow-cone with a *vertical* axis.

There can be no question that Mr. Searle has done an important service to science in collecting and editing in so excellent a manner the hitherto scattered observations relating to his subject.

— Dr. Ernst Haeckel of Jena has been elected a member of the Linnean society for his studies of sponges, Medusae, etc.; also Dr. Alexander Kowalevsky of Odessa, for his zoölogical researches, and Dr. S. Schwendener of Berlin, for his studies in cryptogamic botany.

— The twelfth part of Edwards's 'Butterflies of North America' is almost entirely devoted to the polymorphic and wide-spread Lycaena pseudargiolus, two plates with over sixty figures being devoted to it. Such wealth of illustration is exceedingly rare and correspondingly valuable, particularly with the more fleeting and less known early stages. Nineteen colored drawings of the larva alone are given; and in execution the illustrations have never been surpassed in the most expensive and careful iconographs. The next number will complete the second series, and we are glad the author shows no sign of discontinuing his costly undertaking.

— The slight tendency to lateral cutting possessed by rivers, on account of the earth's rotation, and known sometimes as 'von Baer's law,' has had its efficiency denied about as often as it has been granted, by those who have written on the matter; and, when granted, it has been too often admitted only for streams following meridional directions.

Mr. G. K. Gilbert contributes a new element to the discussion of 'the sufficiency of terrestrial rotation for the deflection of streams,' in a paper read to the National academy of sciences in April, and recently published in the *American journal of science*. Taking Ferrel's measure of the deflective force that comes from the earth's rotation, Mr. Gilbert shows, by a remarkably simple consideration, that its value is not so much in throwing the whole stream against its right bank, as in selecting the swifter threads of the current, and carrying them against the bank; and, further, that this action will have especially well marked development in meandering streams, where it will aid the cutting on the meanders of right-hand convexity, and diminish it on those of left-hand convexity. For the Mississippi, the selective tendency thus determined toward the right bank is nearly nine per cent greater than toward the left; but it is not stated that the valley form has been noticeably affected by this preference. On Long Island, however, the form of the valleys is clearly controlled by the earth's turning, as was first suggested by Mr. Elias Lewis some years ago, and recently confirmed by Mr. I. C. Russell.

The article by Mr. Gilbert advances the question not only by properly applying the law to rivers flowing in any direction, but further by giving it a more delicate analysis than it has yet received, with the conclusion that in certain favorable cases the form of a valley may be decidedly influenced by this hidden control. While the result is of interest to physical-geographers, the method of analysis has a wider

importance. The application of mathematics to terrestrial physics has too often been fruitless from dealing with problems in a simplified or idealized form that departs too widely from the complications of natural conditions. This was notably the case with the supposed demonstrations obtained by Hopkins in his geological speculations. It is therefore gratifying to find that the increased value of von Baer's law, now found by Gilbert, comes essentially from a close consideration of the actual rather than of the ideal conditions of river-flow. It is an advance in the application of mathematics as well as in the explanation of facts.

The lateral tendency of rivers was first noticed in the case of the Volga, which undercuts its right bank, as it should in this hemisphere. Other examples are found in North Carolina, in the channels of the streams flowing eastward to the coast, where the southern banks are the steeper; again on Long Island, and on the plains of New Zealand. But the radial valleys of south-western France afford better illustrations than any of these, inasmuch as their forms are accurately shown on the great map of the army engineers. North of the Pyrenees, about the towns of Tarbes and Auch, there is an old sandy delta deposit spread out by the rivers from the mountains while this region was still under water; and since its elevation, the streams formed upon it all follow its gentle slopes, diverging like the ribs of a fan from the higher centre toward the lower margin, and cutting down their channels into the old delta plain. There is nothing here in the flat layers of unconsolidated sands to determine an unsymmetrical form in the valleys: and yet they all show most distinctly a gentle slope on the left, and a steeper slope on the right; longer lateral branches on the left, and shorter ones on the right; and many of the highways, constructed parallel to the streams on the as yet unbroken uplands, are clearly closer to the streams on their left than on their right. All this is a direct effect of the earth's rotation.

It is customary, in speaking of the deflective force that arises from the earth's rotation, to say that it acts to the right in the northern hemisphere, but to the left in the southern. The reason for this is not found in a change in the direction of the force, but only in a change in our way of looking at it. It is as if one should look at the face of a watch in the northern hemisphere, and say that the hands turn to the right, and then, on going to the southern hemisphere, look at the back of the watch, and say that the hands turn to the left. Let us therefore suggest that the geographers of the southern hemisphere look at their winds and storms and streams from the proper side, just as they look at their watches; and, although this would involve them in the slight inconvenience of standing on their heads, it would give them the moral satisfaction of seeing that the deflective forces of the earth's rotation, as well as the hands of their watches, always 'make for the right.'

— Mr. Lockyer has given an account of a recent visit to the observatory at Nice, the building of which is due to the munificence of Mr. Bischoffsheim, the well-known French banker. In connection with this, Mr. Lockyer presents some striking ideas respecting the future of physical observations of the heavenly bodies. He suggests that it is now time to abolish the observer entirely, and that any astronomer would be losing his time by attempting to draw either the nebula of Orion or the spectra of stars. Photography should take the place of hand-drawing for both of these purposes. He pictures an astronomer, one thousand years hence, in a room filled with photographs giving a picture of every part of the heavens, from pole to pole, as it appears to us in the nineteenth century. By using a different form of telescope, the expense of a dome could be avoided. Altogether, Mr. Lockyer's suggestions are well worthy the attention of all engaged in planning observatories.

— In 1885 an exhibition of inventions is to be held at South Kensington under the patronage of the Prince of Wales. The first part of the exhibition is to be of all inventions made or brought into use since 1882; the second part is to be of all musical instruments invented since 1800. The committee of the first exhibition includes many of the most eminent scientific men in England.

— The *Illustrirte zeitung* reports an interesting discovery in the department of photography. Eleven years ago Professor Vogel of Berlin explained a method by which the effects of colors, such as blue and yellow, might remain unchanged as to light and shade, and which would overcome this difficulty of photography. He has now worked out a process on this principle with practical success: it is published in the *Photographischen mittheilungen*, and the German photographic society has awarded him a prize for it.

— Professor Carnoy, of the Catholic university of Bouvain, announces a work on 'Biologie cellulaire,' which will treat of the general characters of cells, both animal and vegetable. He proposes to deal with the general organization, chemistry, and physiology of cells, basing his work upon original observations, either new, or confirmatory of previous researches. He promises over four hundred new illustrations, engraved with great care and accuracy. The scheme is ambitious; but, if well carried out, it will secure us a valuable book on an aspect of biology too little heeded at present. Professor Carnoy is a botanist, whose reputation will rise high if his volume fulfils the promises of the prospectus. It is to be published at Lierre, Belgium, by Joseph Van In & Cie. The price to subscribers is twenty-five francs.

— If an observatory is to be judged by the number of its astronomers and the variety of its work, that of Paris must rank as the first in the world. The most important work now in progress is the construction of the great catalogue of stars observed during the past thirty years, the printing of which has been commenced. The Bischoffsheim circle, known as the 'cercle du jardin,' has thus far been used only for day observations. One of the most important improvements has been the introduction of the shallow amalgamated basin for holding the quicksilver used in the artificial horizon. Very careful experi-

ments have been made to ascertain whether the level of the quicksilver in this basin remains unchanged after any slight motion. To test this, alternate observations were made with the amalgamated and with the ordinary basin. The results show conclusively that the amalgamated basin preserves its level perfectly. Moreover, the disturbance produced by the passage of carriages in the neighboring street is scarcely perceptible, so that it is now possible to observe the nadir at any hour of the day with perfect ease. The result is, that one of the great objections to building an observatory in the neighborhood of a railway is done away with.

— A new observatory has been recently established on a mountain in the south of France, known as Pic de Midi. Here Mr. Thollon has erected his most powerful spectroscope, and reports that he can see daily forty rays of the chromosphere in a region where ordinarily only eight are visible. He also makes the new and interesting observation that the granulations of the photosphere are visible in his spectroscope as fine striae extending through the whole length of the spectrum. What is yet more curious, similar granulations seem to show themselves in the chromosphere, being indicated by the character of the hydrogen lines, which are broken up into small pieces instead of being continuous. It may be remarked, in this connection, that this observatory is not a purely governmental one, but has been constructed with the funds donated by various private individuals and scientific bodies of France.

— The University of the state of Missouri has commenced the issue of a Bulletin of its museum by the publication of a paper on Niagara fossils by Prof. J. W. Spencer, its director. It is mostly devoted to graptolites and Stromatoporidae of this formation, and is illustrated by eight plates, rather rudely executed, but apparently tolerably well drawn.

— The *Academy* announces that Professor Mayor of St. John's college, Cambridge, will be obliged by the communication of any reminiscences of the late Dr. Isaac Todhunter, or of any letters written by him.

— Engineers, manufacturers, and others interested in the progress of mechanical science, and wishing to attend the meetings of the mechanical section of the American association at Philadelphia next September, should send to the secretary (J. B. Webb), at Ithaca, N.Y., for membership blanks, or abstract blanks in case it is their intention to prepare a paper for the meeting.

— It is reported that Prof. C. E. Bessey, of the State agricultural college of Iowa, has been offered a professorship of botany and horticulture at the University of Nebraska.

— We learn from *Engineering*, that Hirn, the French astronomer and physicist, has devised an apparatus for determining the actual calorific power of the solar rays. An alembic of copper containing sulphuric ether is exposed to the sunshine. The heat absorbed volatilizes the liquid, which is condensed in the alembic. Regnault's formula is employed to calculate the solar heat absorbed from the quantity of liquid condensed.

— According to the tables recently published by the Direction générale des contributions indirectes, the total production of alcohols in 1883 amounted to 2,011,016 hectolitres. This is an increase of 244,450 hectolitres over the year 1882, and 508,439 hectolitres more than the mean of the last ten years. This increase is due in great part to the advance made in the manufacture of spirituous liquors by the distillation of farinaceous substances.

— The fifth annual report of the museum of the Ohio Wesleyan university states that the additions during the year amounted to seventeen hundred and ninety. The need of more shelf-room is much felt.

— Dr. H. Ploss, whose well-known work, 'Das kind in brauch und sitte der völker,' appeared last year in its second edition, announces for immediate publication, in parts, 'Das weib in der na ur- und völkerkunde.' The prospectus states that it will treat of the natural history of woman, principally from an anthropological stand-point, and as it appears to the naturalist and sociologist. The work is to be published at Leipzig, by Grieben, in eight lieferungen: price two marks each. When complete, they will form two volumes, 8vo.

— There are now twenty-three countries with a total population of 241,973,011, in which the metric system of weights and measures is the legal standard; four (Canada, Great Britain, United States, and Persia) with a population of 97,639,825, in which the system may be used; and six, including Russia and British India, with a population of 333,266,386, in which the system has no legal standing.

— The report of the North Carolina agricultural experiment-station for 1883 is almost wholly devoted to commercial fertilizers; although a few analyses of fodders are reported, and more or less work is mentioned as having been done for the state geologist and the state board of health which is not reported here. The most generally interesting portion of the report is that concerning the recently explored deposits of phosphatic nodules and rock in the state, some account of which has already been given by Dr. Dabney in *Science*, iii. 31.

— A convention of agricultural chemists, which met in Atlanta, Ga., May 15 and 16, appointed Prof. S. W. Johnson of Connecticut, Prof. H. C. White of Georgia, and Prof. W. C. Stubbs of Alabama, a committee to propose a method for the determination of phosphoric acid in fertilizers. Their report, which is too long for reproduction here, recommends a method for general use for the twelve months following its date, and promises further investigation and a report at a future time. It was resolved by the convention, "that this method be not considered as binding upon any one, but that the convention recommends it to the profession, and hopes that all not bound by conflicting obligations will follow it."